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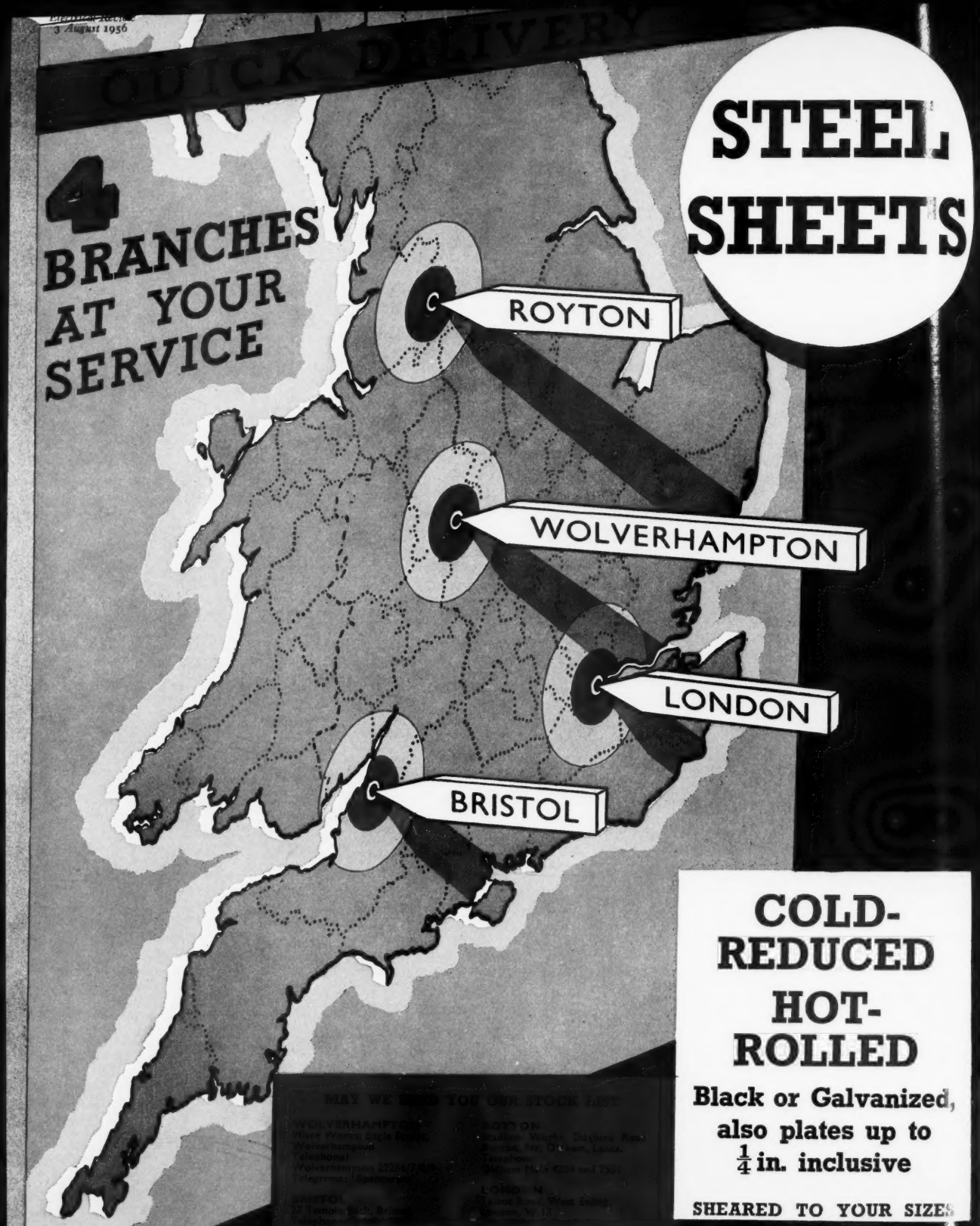

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Technical Editor: P. W. TUCKER, M.I.E.E.

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3 August 1956 Vol. 159 No. 5 Established 1872

Atomic Co-operation

THE second annual report of the United Kingdom Atomic Energy Authority, which we summarise in this issue, indicates the end of an era. Atomic energy development is no longer the exclusive prerogative of Government agencies but is virtually open to any organisation with the necessary will and resources to carry it on.

It is striking throughout the report how much the Authority is now the source of help and guidance to all the varied private and national concerns now entering the field of atomic energy. The year has seen the release from security restrictions of virtually all the basic information needed for the development of peaceful applications of atomic energy, the formation of four consortiums of power plant manufacturers to undertake atomic plant construction, and the establishment by these groups of a nucleus of design staff. The role of the A.E.A. in all this has been noteworthy. It regards the dissemination of the maximum amount of technical information compatible with security as one of its principal responsibilities at the present time, and it has organised special training courses and supplied a whole range of its technical reports and drawings of the Calder Hall project to each of the industrial groups, to assist in building up background knowledge.

The first fruits of all this will be seen in October when the Central Electricity Authority is to receive tenders from the four groups for the first two stations of the nuclear power programme intended solely for power and constructed entirely by private enterprise.

After its splendid work in helping to lay the foundations of a new industry, the Reactor School at Harwell is being enlarged and now accepts overseas students. Plans are being made to provide a variety of courses to meet different needs. Even classified information, provided it is really needed and security precautions are observed, is being made available to private groups; but throughout, the Authority is following the reasonable policy that nothing should be exclusive to one firm and that the Authority should be entitled to a reasonable financial return for valuable information and patents built up at the taxpayer's expense.

Such an enormous transfer of technical " know how " can never before have been carried out in such a very short space of time. The real flowering of the policy should be seen in the next five years in the form of more economic plants, more efficient plants and perhaps new types of plants. There can be little doubt of the debt that will then be owed to the A.E.A. for its conduct in the past year.

NUCLEAR ENERGY AND PUMPED STORAGE

On another page we report the decision of the South of Scotland Electricity Board to build a nuclear energy power station in its area. One of the most interesting points about this announcement is that in order to maintain adequate night load for the station and the other base load stations in the South of Scotland the Board is considering schemes involving the use of pumped storage.

This proposal supports the view of the substantial school of thought which contends that probably the greater value of nuclear energy generation will lie in the possibilities of its use in conjunction with pumped storage. What can be said with reasonable certainty is that this is obviously the case in such countries as Scotland where it is possible to construct high level reservoirs at fairly reasonable capital cost.

STEEL FOR POWER STATIONS

We recently received the following inquiry: "How much steel is used in an average power station of, say, 500 MW?" Quite apart from the fact that we do not think that 500 MW can be regarded as representing the capacity of the average power station, we had to say frankly that we had very little idea and had to pass the inquiry on to the Central Electricity Authority. Incidentally, we wonder to what extent the Authority had to carry out a research to provide the correct answer to the question.

Actually we have been told that the overall amount of steel is of the order of something like 40,000 tons. Be that as it may the figure is obviously colossal. Apart from the large quantities used in the construction of the power station buildings, the boiler plant is just one mass of steel, as is also the turbine. Further, in the alternator steel is obviously the greatest component and there are the switchgear frames and transformer housings, to say nothing of numerous auxiliary equipments in every power station.

All this brings to our mind the many times we have referred to the interdependence and interlinking of the electricity and steel industries and it supports our oft-repeated contention that the fortunes of both industries are closely tied.

CIRCUIT-BREAKER TESTING

The appearance of a new publication of the Association of Short-Circuit Testing Authorities, "Certificates of Rating with special reference to Supplementary Proving Tests of Circuit-Breakers," which is referred to elsewhere in this issue, draws attention once again to the extreme need for such a testing organisation as A.S.T.A., to the far-sightedness of all those manufacturers and others who were responsible for its establishment, and to the important work carried out by the organisation since its formation. The day is now gone when development work of a switchgear manufacturing concern might be retarded or even arrested simply because of lack of facilities for proving the capabilities of its products.

The new publication is evidence of the progressive policy of A.S.T.A. In the absence of standard specifications for certain kinds of apparatus, the Association has been obliged to formulate and publish rules for the short-circuit testing of these types. The Association also permits minor deviations in testing procedure such as might be necessitated by plant limitations.

It has been recognised that while the short-circuit tests specified by the various British Standards and A.S.T.A. rules provide a sound basis for proving all types of circuit-breaker, it is sometimes desirable to make supplementary proving tests, the nature of which will depend upon the characteristics of the particular type of circuit-breaker being tested. It is anticipated that such supplementary proving tests may be incorporated in future revisions of the appropriate British Standards.

TURBO-ALTERNATORS AND FLEXIBILITY

In our last issue we reported that the Central Electricity Authority had received the Minister of Fuel and Power's approval of a scheme to install in various power stations thirteen 120 MW turbo-alternators in place of the twenty-six 60 MW sets which had originally been provided for. The stations in question are Rugeley, Staythorpe "B," Skelton Grange "B," Uskmouth "B" and Belvedere.

The main reasons given for the change are a substantial reduction of capital costs and improvement in thermal efficiency of the 120 MW set with reheating. We feel, however, that there is another aspect of at least as much importance. Until recently the set above 60 MW had been regarded as essentially a base load plant, and if the 60 MW set is to disappear it rather looks as though the larger set can be depended upon more in terms of flexibility of load operation. On the other hand, nothing has been said about the 30 MW set, many of which are being installed as separate extensions to the plant of existing stations as well as in new stations. We therefore feel it is probable that the 30 MW set will be relied on even more for flexibility of operation under efficient loading conditions.

THE G.E.C. REPORT

The financial results of the General Electric Co., Ltd., are, owing to the wide ramifications of the company, and the scope of its products, a barometer of the "weather" conditions in the electrical manufacturing industry of this country both as regards the home market and the demand overseas. It is satisfactory to learn, therefore, that the company's exports reached a record figure during the year ended 31st March last. Rising costs both in production and distribution, however, have reduced the margin of profit, and the difficult trading conditions for certain consumer goods, following the Government's measures to curb expenditure, have also been a contributory factor in the lower profits. Although exports increased, the overseas companies experienced a difficult year owing to keen competition, import restrictions and local manufacture. Despite these difficulties, however, the order book for capital goods remains satisfactory, although the falling-off in certain consumer goods continues.

Machine Tool Control

An Account of a Number of Systems and their Applications

By C. K. MARKLEW*

MOST machine tool development has been concerned with reducing human effort and increasing the utility of the machine. Although it appears, owing to the present popularity of the subject, that most of the development is the result of work during the last few years, what we know to-day is no more than the outcome of normal evolutionary processes just as in other spheres of activity.

Many of the latest technological advances are the result of advanced work on control devices needed during the war, and these have been related to the post-war lack of skilled labour, the need for higher production rates at ever increasing accuracies, and the realisation that man's attention can only be focused for a limited period.

A machine can or should be able to reproduce more or less exactly within the limits of the original design with the minimum of attention. Whether it does or not depends on the reliability of the control system. This, of course, assumes that basic structures, tools, speeds, feeds, and so on, are correct. By these standards, automatic controls gain or lose ground and it is regrettable that along with the new enthusiasm for more and more automation there has been suspicion and mistrust fostered by wrong employment of devices unsuitable for the industrial field.

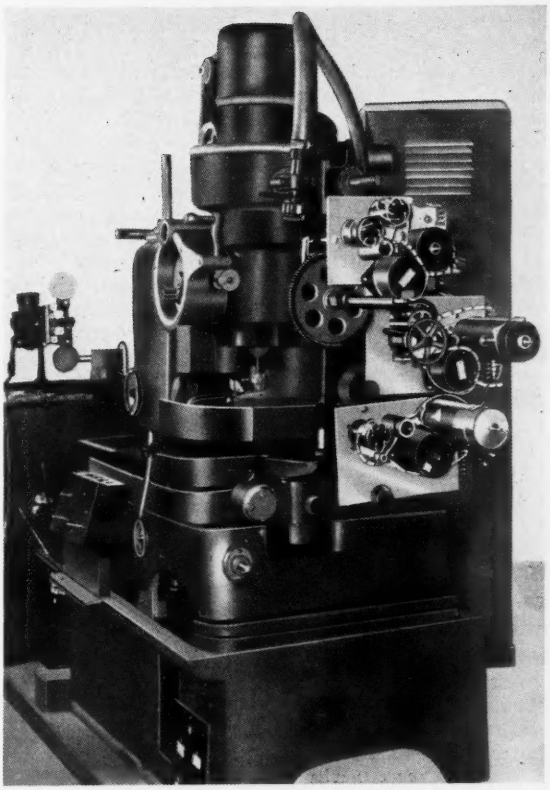
Popular Misconceptions

Some over-enthusiasm of application is due to lack of appreciation of what can be done by other means and what has been done in the past with simpler devices. There is a tendency to regard "programming," automation, or automatising, as completely modern conceptions. Similarly there have been many claims for pieces of inanimate equipment which are said to have almost human attributes; thus we have "electronic brains," "memory devices" and so on. These descriptions are misleading when purely electro-mechanical processes are involved.

It is true that an element of choice seems apparent in the operation of some of these devices, but there is nothing like a human thought process taking place when the choice is made. In fact, the device does what it does simply because it has no choice—it can only do what is built into it in the first place.

Although it is not always easy to suggest alternative names for some of this equipment, the new jargon tends to confuse rather than to clarify. For example, "programming" is no newer than the musical box, and programming a tune is as involved as programming a machine cycle, although the relationship between the types of equipment used may not be very obvious. Similarly, there have been in use for many years machines which can be controlled electro-hydraulically or electro-mechanically through complicated sequences.

The Keller die-sinking machine, for instance, was first introduced into this country in 1929 and reproduces a model extremely accurately through a control system using a sensitively balanced tracer which contacts the model and directs, according to the deflection of a number of contacts, magnetic clutches which trip in and out the various machine slides. Some distance below the tracer is a revolving cutter which machines the workpiece in a one-to-one ratio of the tracer deflection. The feed motions are operated by constantly running d.c. motors having pre-set speed controls, altered by varying the armature voltage. Although over the years the design of this machine has changed, and many improvements have been made, the basic construction remains the same.



Fellows 72A gear shaper automatically controlled to machine non-circular gears

Similarly, the Heald "Borematic" is a machine which has a long history. It can perform a number of machining operations automatically, such as boring, turning, facing, chamfering, and grooving, and the automatic sequence of operations is accomplished by limit switches and relays, energising and de-energising solenoid-operated hydraulic valves in a complicated circuitry of a conventional kind. On this type of machine, repetitive limits of 0·00025in can be maintained in production and generally with unskilled labour. A further development relating to this type of machine will be mentioned later.

One of the first fully developed programming applications is undoubtedly the Jacquard loom, now about 150 years old. Machinery operated from the patterns of punched holes in cards or paper is in wide use today and during the last few years a number of machine tools have been adapted to work on the same principle. The most comprehensive application was developed by the Massa-

* Mr. Marklew is with Alfred Herbert, Ltd.

chusetts Institute of Technology by conversion of a Cincinnati Hydrotel contour milling machine.

On this machine the paper tape carries an arrangement of holes which is passed over finger contacts. The sensing of the contacts through the pattern determines the amplitude of signal voltages and the rate and number of pulses are then handled by a register in a similar way to a telephone exchange system. The machine is controlled by servo motors, and feed back from the machine is summed up by another register and compared with the input pulses. The error voltage resulting is applied to a decoding servo which corrects the machine movement. Electronic digital computer equipment is required to translate the register data in a suitable form for the machine servo mechanisms to handle. To record, it is necessary to reduce the dimensions of the work to be machined into numerical co-ordinates, which are converted by computer equipment into the required form for coding on to the tape.

Some of the holes in the tape determine the machine movements, others give a time signal and the rate of slide feed is proportional to the rate at which the pulses are delivered. Approximately 10ft of tape is sufficient to operate the M.I.T. machine for an hour, and the overall machine accuracy is claimed to be to 0·001in.

Control by Cinematograph Film

Another American development is the system designed by the Arma Corporation for a 72A Fellows gear shaper which was automatically controlled to machine non-circular gears of great accuracy for tank-gun range finders.

The three basic motions of the machine—work rotation, cutter rotation, and work cutter centre distance—were fitted with servo-mechanism drives and controlled by pulses derived from 16mm cinematograph film. The exposed film consists of three horizontal rows of rectangular spots, each spot corresponding to a step of the basic motions. From the blueprint of the gear to be machined, the relationship between the rotation of the work and cutter and the distance between their centres is determined at a sufficient number of points to give the desired accuracy and the number of steps for each of the above motions can then be determined.

An exposure device containing a number of lights is flashed in accordance with the worked out code and each combination of flashes automatically indexes the film to the next exposure position. At present, the calculation and interpolation of the digits corresponding to about 20,000 spots on the film requires about a week's work, but a device is said to be under construction to reduce the time for calculation and exposure of the film to one day's work. When the film is completed, the operation of the machine is effected by projecting the spots on to a series of photo-electric cells, the outputs of which are amplified and fed to relays operating ratchet mechanisms which, in turn, pulse selsyn transmitters controlling the machine servo mechanisms.

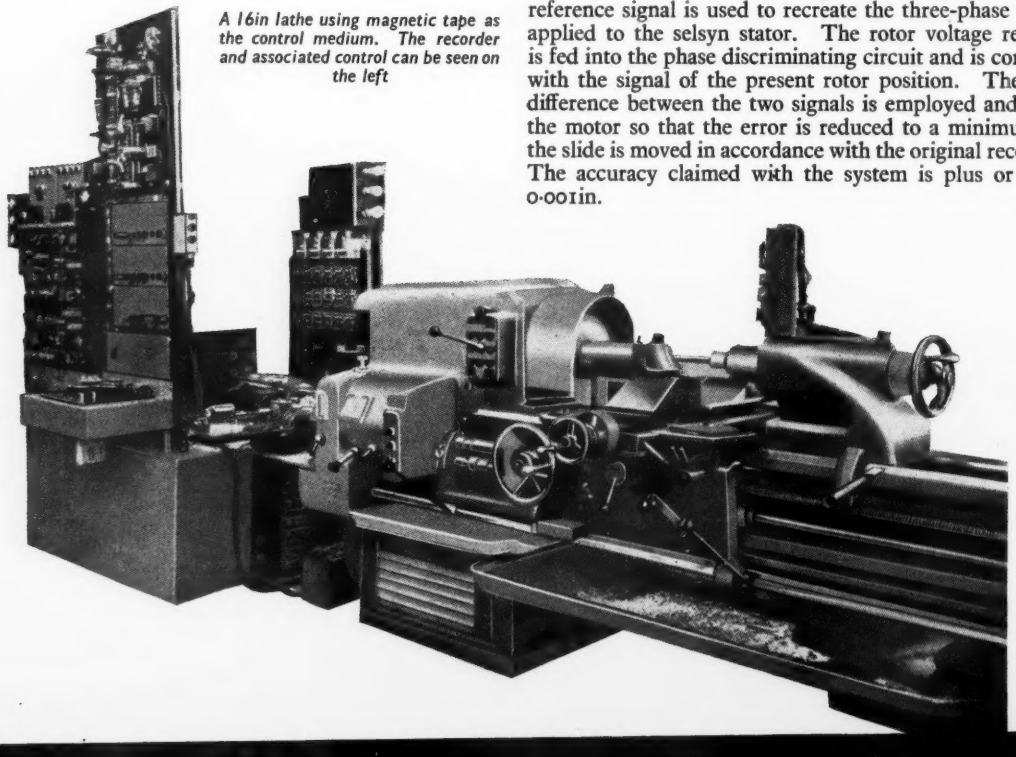
Magnetic Tape Systems

The next two examples use magnetic tape as the control medium. The first system by G.E. of America, known as record play back control, has been applied to a Giddings & Lewis aircraft skin milling machine. Geared selsyns are fitted to the machine motions and transmit signals of position when the machine is operated manually to produce one component. The signals are translated into suitable input form to recording heads and an analogue of position is thereby impressed on the tape. Each movement requires a separate tape channel and the number of channels therefore depends on the number of different motions or operations on the machine.

The photograph below shows a lathe fitted with an earlier but similar type of control. The tape recorder and its associated control can be seen on the left and the two basic slide motions are being controlled.

One motor is fitted to the lead screw driving the saddle movement longitudinally and the other motor is fitted to the crossfeed lead screw transversely. Selsyns are connected to the shaft extensions of the normally non-driving ends of the motors, and amplidynes or rotating d.c. amplifiers feed the motors electrically, to control starting, stopping and speed variation.

Fig. 1 describes the operation of the equipment. The transmitter selsyn is rotated either by hand or automatically on the machine, and whilst one component is being machined a reference voltage representing the relative phase between rotor and stator of the selsyn is recorded, together with the rotor signal. On play-back, the reference signal is used to recreate the three-phase voltage applied to the selsyn stator. The rotor voltage recorded is fed into the phase discriminating circuit and is compared with the signal of the present rotor position. The phase difference between the two signals is employed and drives the motor so that the error is reduced to a minimum and the slide is moved in accordance with the original recording. The accuracy claimed with the system is plus or minus 0·001in.



A 16in lathe using magnetic tape as the control medium. The recorder and associated control can be seen on the left

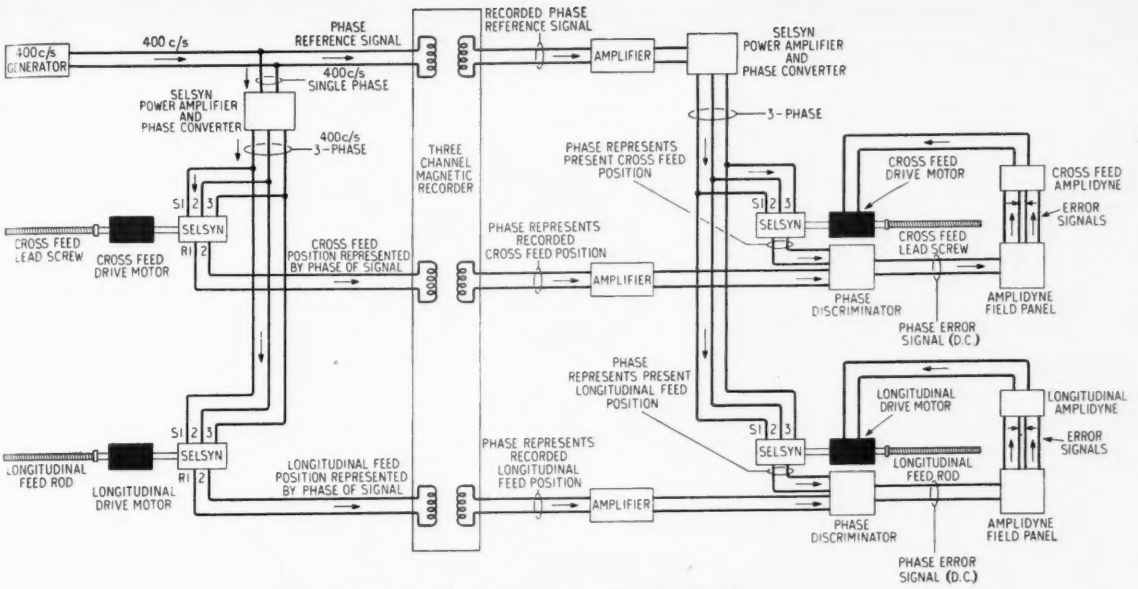


Fig. 1.—Block diagram of control system for the 16in lathe

The much simpler system developed by Alfred Herbert, Ltd., for controlling the sequences only of a hydraulically operated boring machine is shown in Fig. 2.

The Heald "Borematic" is a good example of a machine which can be fitted up with an unlimited number of automatic cycles through permutation and combination of electrical and hydraulic elements and which, once set, gives a remarkable degree of accuracy.

The time spent in working out on paper the electrical sequence and in wiring the machine grows correspondingly larger as the cycle increases in complexity. Normally, the time element does not matter too much, particularly when a work change is most unlikely. All movements of the machine are carried out by solenoid-operated hydraulic valves through limit switches and relays. Unfortunately, it often happens that the job is not complete after it has left the drawing office; and even after the machine has been wired up, a slight design alteration on the component or practical experiment when machining may indicate the desirability of a change of method.

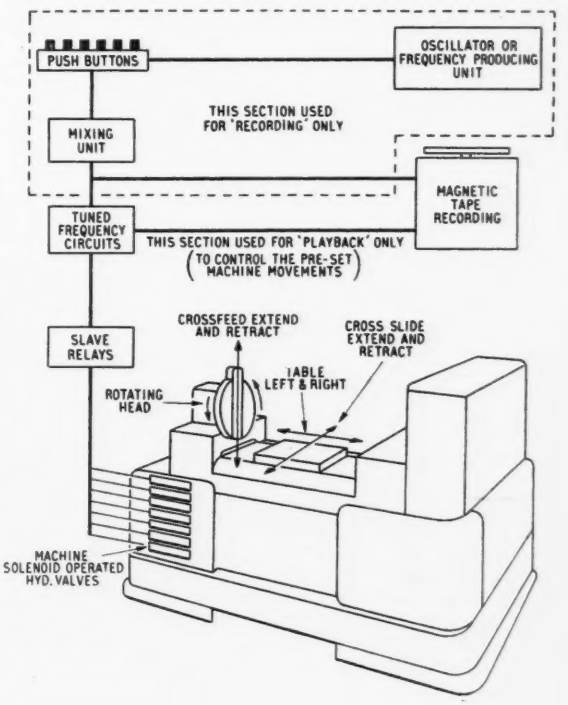
It may be proved upon demonstration that a few seconds can be saved on each component by some improvement in the operation. It is not easy at this point to make a change in sequence and the effort to do so quickly and easily without completely re-designing the layout means that crossword and jigsaw puzzle tactics must be resorted to. Not the least difficult part of this process is the actual physical wiring alteration after the change has been decided on paper.

It follows then that a simple method of producing sequences of movement at will provides a solution to all these difficulties and makes a machine of this type extremely versatile without affecting its inherent accuracy. This is a point which is worth emphasising once again. The accuracy of the "Borematic" is easily obtained by conventional mechanical methods and any programming system can therefore dispense, within limits, with the usual elaborate precautions for obtaining precise movement direct from the programmed material. The equipment can thus be simple, robust and comparatively inexpensive. In fact, in the system to be described, the cost compares more than favourably with the conventional method of doing the same sequence.

All the normal wiring, relays and limit switches have been removed from the machine, leaving only the solenoid-operated hydraulic valves, the main motor, and starter.

The solenoid valves are connected directly to the slave relays on a 110 V supply, these being actuated by tuned reed relays or tuned frequency circuits. Each reed relay is responsive to only one frequency and is applied to one individual machine movement. The audio-frequencies are produced by resistance capacity oscillators and are identical in construction. They are separately variable

Fig. 2.—Prototype magnetic tape-control system for a Heald "Borematic"


PUSH BUTTONS
OSCILLATOR OR FREQUENCY PRODUCING UNIT
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TUNED FREQUENCY CIRCUITS
THIS SECTION USED FOR 'PLAYBACK' ONLY (TO CONTROL THE PRE-SET MACHINE MOVEMENTS)
SLAVE RELAYS
CROSSFEED EXTEND AND RETRACT
CROSS SLIDE EXTEND AND RETRACT
TABLE LEFT & RIGHT
ROTATING HEAD
MACHINE SOLENOID OPERATED HYD. VALVES

over the required range of frequencies and setting control for tuning before recording is by potentiometer in one of the ratio arms of the resistance capacity bridge circuit.

Each oscillator is connected via a single-pole push-button switch to a triode output stage and from then on the six anodes are paralleled together. The triodes act as impedance matching devices and prevent de-tuning of the oscillators by the reed relays. If all the push-buttons are pressed together, all six superimposed frequencies can be supplied to the bank of reed relays via two lines and also to the record terminals of the tape recorder and each reed relay selects its own particular frequency. The sequence of recording consists of pressing the correct machine function button and applying a frequency to the reed relays. The appropriate relay operates to energise the slave relay controlling the solenoid valve. At the same time—and for the same length of time as the button is pressed—the frequency is impressed on the magnetic tape. At the end of the movement, the button is released and the recording is interrupted.

This procedure is followed to record all the machine movements. If the machining operations allow a number of movements to take place simultaneously, the total combination of frequencies can be as easily recorded. When the cycle is completed manually, the signals of each movement are locked together inherently in the tape.

This system uses one track only to record all movements, and apart from the resultant simplicity of the equipment in general and the tape recorder in particular, it has the advantage that if a fault in the play-back circuit occurs on breakdown of play-back head or tape, then all machine movements will stop. Also, it is reasonable to assume that if, by any mischance, intelligence of a particular frequency is erased, then the same fault will apply to all the frequencies.

When recording, care is taken to see that the machine slides squeeze against their appropriate dead stops, and therefore, as the tendency of the machine is always to run more quickly when the oil is warm, there will be a slight delay at the completion of each movement.

Apart from the points already made, it was not thought worth while, for two reasons, to make the tape an absolute reference of measurement on this machine. Firstly, the hydraulic pressures used are in the region of 80 to 100 lb/sq in, and secondly, the solenoid valves are rather large and slow acting. The speed response therefore is not instantaneous. By changing the hydraulic equipment, introducing higher pressures and low inertia quick-acting valves, instantaneous or near instantaneous response could be obtained and might make accuracy from the tape a proposition.

There are many machines where accuracy of movement is or could be defined by dead-stops and these are perfect examples of suitable applications for this type of equipment. There are instances also, not only in the machine tool field, where patterns of movement are required in an easy-to-set and easy-to-change form.

Positioning Control

The systems so far discussed rely on the accuracy of machine lead screws or dead stops to give accuracy of position. This question of positioning control is one of the most important developments in recent years. There are a number of machines on the market, of which the Devlieg jig mill is one, which can accurately position to 0·0001in and this is accomplished automatically through conventional a.c. motors which drive the slide against accurately finished length bars. The length bars themselves do not act as dead stops in the mechanical sense, they operate a repetitive switchgear sequence which causes the mechanism to trip with great accuracy. The path of travel of the slide is shown diagrammatically in Fig. 3. Naturally, systems like the Ferranti and B.T.H. are concerned with getting rid of the necessity for changing these length bars. Both these systems have been reported in greater detail than can be given here, but it would be worth while to recall the main features once again.

Ferranti Method

In the Ferranti control scheme, the measuring equipment fitted to the machine consists of two diffraction gratings—one fitted to the slide and the other to a fixed member and arranged so that one grating slides over the other. When a beam of parallel light is projected through the gratings, the optical fringe pattern produced varies the intensity of light appearing through the grating. For each movement of the slide equal to the pitch of the grating, one complete cycle of light variation will occur and two distinct pulses per grating division can be counted by photo cells and electronic counters.

The direction of movement of the slide is noted by the direction of phase rotation corresponding to the signals received at the photo-cells. The accuracy of the movement is determined by the comparison between the signal governing direction, rate and length of feed, with the feedback pulses from the gratings on the machine. When the number of pulses from the machine equals the number transmitted to the servo-mechanisms, the slide stops.

The data for the machining operations is transferred from the drawings of the component to punched paper tape and thence by digital computer to magnetic tape. The component drawing is somewhat unorthodox in so far as all measurements are taken from a datum point and form co-ordinates of all points of change. The paper tape contains basic information in a condensed form but interpolation of further points between co-ordinates is necessary before enough practical machining instructions are recorded to provide a correct reference of cutting tool motion.

A digital computer is used to establish these further points of reference and can also plot them from the equation of a curve or radius. This information is then recorded on the magnetic tape in the form of a series of pulses for each slide and with correct relationship to each other. The speed of the pulses determines the rate of feed and the number determines the total distance the slide moves. This method of control involves using multi-track magnetic

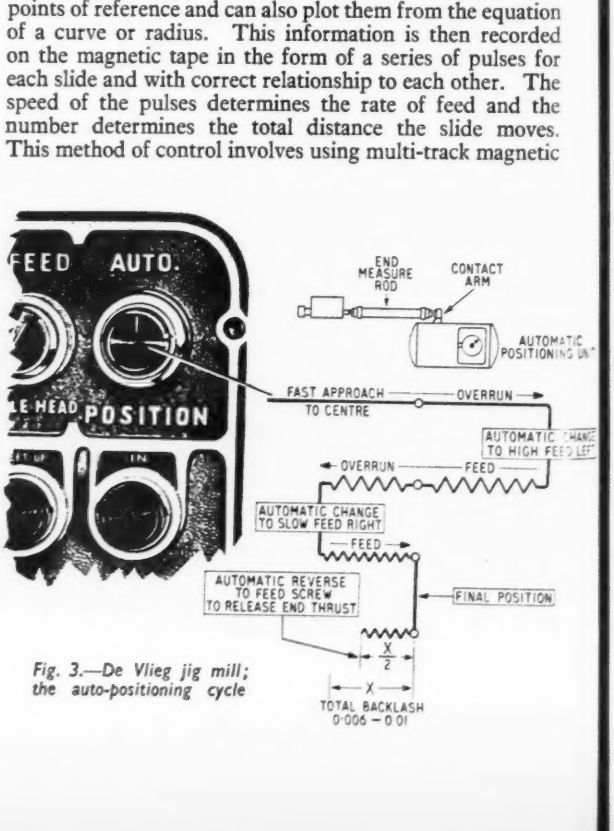
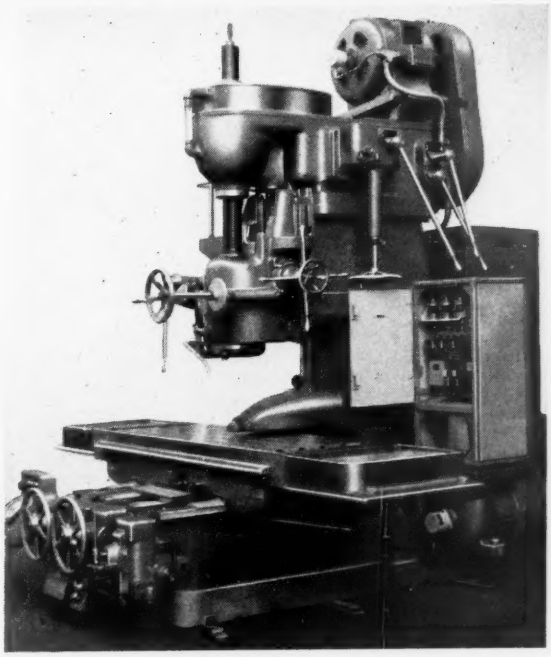


Fig. 3.—De Vlieg jig mill; the auto-positioning cycle



Alfred Herbert 28A milling machine with electronically controlled variable feed

tape as a separate channel is required for each movement. Three channels are used for the control described, for basic machine movements and a fourth channel is used for recording the intermittent functions, for example, switching of the main motor, coolant pump, and so on.

B.T.H. Control System

The B.T.H. scheme is an analogue system combined with an electro-magnetic measuring bar, having a series of holes spaced one inch apart and filled with non-magnetic material. Associated with the measuring bar is a detector-head consisting of a differential transformer which can be driven along a small slide by an electric motor. The measuring bar is mounted on the main machine slide and the detector-head on the machine bed and aligned with it. The operator's controls consist of a set of dials which are set to correspond with the required dimension. The dials corresponding to " inches," rotate a master synchro which is coupled with a similar synchro on the machine drive lead screw.

The decimal part of the dimension is controlled by four dials which operate a set of synchros coupled with a corresponding set on the detector-head. The positioning of the slide consists in controlling the drive until the travel is within about $\frac{1}{4}$in of its correct position. This is done by a single synchro on the lead screw. At this point the slide stops and positioning is completed by the detector head, which continues to allow the motor to drive until the poles of the detector head are in a symmetrical relationship to the nearest hole in the measuring bar. The speed control of the d.c. driving motor is through a rotating d.c. amplifier.

The same firm has recently produced a very interesting tracer control system for application to lathes and milling machines, which operates from a variation in inductance of a magnetic field system upon deflection of the tracer stylus. The effect is continually to speed up and slow down the driving motions in accordance with the template and so avoid a separate action.

Probably the most universal application of electronic gear to machine tools is to provide very wide range speed variations for feed drives, and one such example is shown here on an Alfred Herbert 28A milling machine. Here the requirements were for an infinitely variable range of table feeds from 0·8-40in/min with the feed motor developing a maximum of 3 h.p. The final design gives 3/3/0·15 h.p. over a speed range 3,000/1,200/60 r.p.m. by field and armature voltage and control from a single-phase thyratron equipment. It is unfortunate that no solution has yet been found to the problem of providing sufficient h.p. at low speeds, since this would be a boon for variable speed headstock and spindle drives.

In the immediate post-war period, many electronic drives lost favour because of the tendency to use components which were not sufficiently robust for use under industrial conditions and also to the abundance of " glassware." Both these criticisms have been answered to a great extent in recent years and the latter point particularly has been improved by an increasing use of magnetic amplifiers instead of thyratrons.

All the examples mentioned are concerned with electro-mechanical or electro-hydraulic control of machine tools, but of course many advances have been made over the same period of time with purely hydraulic and pneumatic systems. This point is mentioned solely as a reminder that there is intense competition between the various methods of approach in control systems and there are instances where the electrical engineer's approach is not the best solution.

The trend in the future towards the building of more and more specialised machines from standard unit parts offers great scope to the electrical and electronic engineering industries, if certain essentials are observed.

First, there have been accusations of apathy in the machine tool industry towards new attitudes and methods, and it is true that, at times, the approach does seem to be very conservative. The fault is not entirely the machine tool manufacturer's, and the eventual user must bear a big proportion of the blame. What the customer will not buy, the manufacturer will not produce.

Secondly, the cost of control equipment must bear some sensible relationship to the cost of the machine tool and the value of the product. Many control schemes are naturally expensive, particularly if they are still in the development stage, but the consistently high cost of some equipment cannot be justified in this country at the present time even though the output from a machine may be tremendously increased.

A third point is that there are many common items of electrical equipment such as limit switches, relays, contactors and selector switches which are so cheap in design and construction that they have earned a bad name for the electrical industry in the machine tool world. It is easy to criticise, but there is often a lack of good mechanical design. Improvement could be achieved by closer study of operating conditions and acceptance of the fact that a design which may be perfectly suitable for one class of industry is not necessarily suitable for use on machine tools. A large number of machine tool users have no maintenance electricians and those who have are often guilty of engaging people having only the slightest electrical knowledge. Although it is hoped that a more healthy attitude will be adopted towards the maintenance of electrical equipment on machine tools, it is essential that simplicity, robustness, and the effects of lack of maintenance should be given prior consideration on new designs, and to this end it is obvious that there must be closer co-operation between the electrical and machine tool industries, and more use made of custom designed equipment.

Left to right: Mr. F. C. How (Lord President's Office), Mr. W. L. Owen (deputy managing director, Industrial Group), Sir John Cockcroft (member for scientific research), Sir Edwin Plowden (chairman of the Authority), Mr. E. H. Underwood (director of public relations), Sir Donald Perrott (member for finance and administration) and Mr. D. E. H. Peirson (secretary)

Atomic Energy Developments

Authority's Second Annual Report

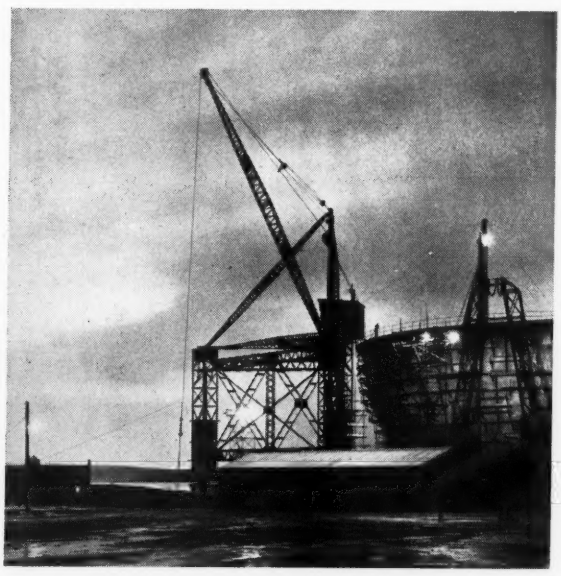
THE second annual report of the United Kingdom Atomic Energy Authority, for the year ended 31st March last, stresses that the dominant feature of the period under review was the very great increase of interest and activity, both in this country and overseas, in the development of nuclear energy as a source of power for peaceful purposes. Security restrictions on publishing information were to a large extent relaxed, the Geneva Conference representing a turning point.

During the year there was a continuously expanding programme throughout the Authority's establishments, necessitating considerable staff additions. Non-industrial staff increased by 30 per cent and industrial staff by 13 per cent, the total staff at the end of the year numbering nearly 24,000. The development of thermo-nuclear weapons continued to have high priority and the rate of increase of staff was greater in the weapons group than in any other. Harwell has now almost reached the maximum reasonable size and the Authority is examining possible new sites with a view to setting up a further major research establishment.

On the subject of atomic energy materials, the report says that there has been a spate of new discoveries of uranium, most of them on the North American continent, and these have been so extensive that they have removed the danger of a world-wide shortage. As world supply grows easier, however, more attention has to be paid to the relative cost of production from new deposits and a figure of about 71s per lb is quoted for uranium contained in high-grade concentrate. The production of uranium metal in the United Kingdom has been increased to meet the requirements of Calder Hall and to maintain supplies to the existing reactors. In the production of plutonium at Windscale a notable achievement has been the steady progress in the development of maintenance techniques for use inside the pile shield. These shields were designed and built on the assumption that access would be impossible once they had been in operation. The success of the techniques developed suggests that the life of an existing reactor may be extended when threatened by mechanical breakdown as it is now practicable to include items of limited life which can be replaced if they break down or wear out.

One section of the report deals with the state of reactors now under construction, notably those at Calder Hall from which electricity will be supplied to the country's grid system on 17th October, when the station will be inaugurated by H.M. the Queen. The second reactor at Calder Hall is progressing well in line with the first but is programmed six months later throughout. In the middle of 1955 the need for increased supplies of plutonium for military purposes led to the decision to build three new units of the Calder Hall type, each consisting of two reactors. One of these is being sited alongside the first Calder Hall unit and the other two at Chapel Cross in Dumfriesshire, where to assist the Authority's staff, Messrs. Merz & McLellan are being employed as consulting engineers for the power station layout and services and as construction agents for the whole project.

At Dounreay the lower half of the protecting sphere has been completed and the floor of the concrete vault which encloses the reactor inside the steel sphere has been finished. When the vault is complete the upper half of the sphere can be erected. Construction of the pumphouse



Night work being carried out on the lower half of the steel safety sphere at the Dounreay site. This half has now been completed and work is in progress on the reactor vault inside

and channels for the sea water to be used for condenser cooling is well advanced.

Great progress has been made on the collaboration scheme with the four groups of industrial firms representing the starting point for the national nuclear power programme. Senior members of the design teams from the firms concerned have attended courses at the A.E.R.E. reactor school followed by more detailed courses of instruction in the establishments of the A.E.A. Industrial Division. A feature of the activity of these four manufacturing groups is that although now competing against each other for very large orders, they have been quite willing to meet regularly for the discussion of design problems and the exchange of information. A committee to co-ordinate major policy on design matters, known as the Nuclear Power Collaboration Committee, has been set up with representatives from the four industrial groups, the A.E.A. and the Central Electricity Authority. More recently representatives have attended from the South of Scotland Electricity Board. A number of working parties have been set up to deal with specific aspects of design and these specialised meetings represent an effective way of placing the experience of the Authority's staff at the disposal of the new industry.

Although the Atomic Energy Authority is inevitably the only source of technical assistance to both the electricity authority and the manufacturing concerns, its departments handling relations with the sellers' and buyers' sides have been divorced as far as possible to avoid an invidious situation.

Research Programme

The Authority's reactor research programme provides for three successive stages in the country's nuclear power programme. The first is that of graphite moderated gas-cooled reactors and a substantial amount of research and development work is still being done on those being designed by industry for the C.E.A., including a study of the reactions between CO_2 coolant and graphite at the temperatures envisaged.

The second stage covers the development of the pressurised water and sodium graphite reactors. These provide higher heat ratings than gas-cooled reactors, but require enriched fuel. Many of the problems involved in these two types of reactor are metallurgical and a great deal of work is being carried out on fuel canning, the corrosion of carbon steels and stainless steels, and the possibilities of containing liquid sodium coolants.

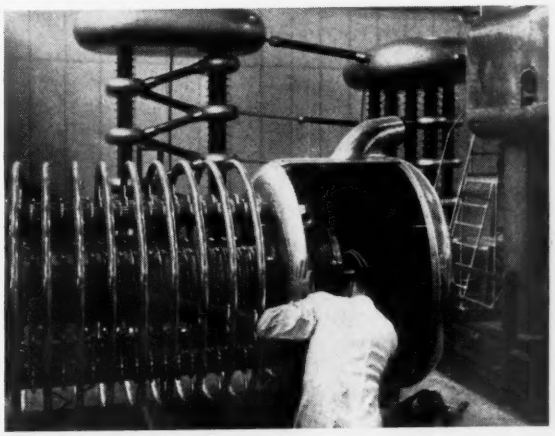
The major objective of the third stage is to achieve a much higher fuel utilisation by breeding further fuel during operation of the reactor. Four systems are being investigated: the fast reactor system, the homogeneous aqueous reactor system, the liquid metal fuelled reactor system, and the high-temperature gas-cooled system. The zero energy fast reactor " ZEPHYR " has been in operation throughout the year and has indicated that a breeding ratio of about two can be obtained in the ideal conditions of a small non-cooled system. During the year " ZEUS," the zero energy version of the Dounreay fast reactor, came into operation and work is now in progress to obtain preliminary information relating to the final design and operation of the Dounreay plant.

During the year the metallurgy of plutonium has been developed towards the more extensive use of plutonium-bearing fuel in the power programme, and methods of fabricating thorium have been the subject of much work. In addition, a considerable effort has been devoted to testing prototype fuel elements for the Calder Hall reactor.

A section of the report which is bound to provoke speculation is that dealing with the production of a controlled thermo-nuclear reactor. It is stated that since 1948 the Atomic Energy Authority and its predecessors have been carrying on a programme of research into the possibilities of obtaining economical power from such a controlled reaction. The availability of abundant fuel such as deuterium and lithium is a strong incentive to achieve this object but the nuclear fuel has to be brought to a temperature in the region of 100 million deg C to make the reaction possible.

It is not yet certain that a power fusion reactor can be built yielding more useful power than it consumes and two main problems have to be solved, namely, to bring a mixture of the light elements to the very high temperature quoted, and to maintain this temperature long enough for the energy released in nuclear fusion to be greater than that required to heat the fuel. Methods of heating the atoms of the reactor elements under conditions which provide good thermal insulation from the walls of the surrounding vessel are being explored. Methods of heating a gas under conditions of good thermal insulation have been tested under laboratory conditions and extremely high temperatures measured, but work is still in the laboratory stage.

Design studies have been initiated on machines to



The high intensity 500,000 eV injector for the 50 MeV proton linear accelerator being built at Harwell

The graphite reflector being installed in the research reactor " DIDO," at Harwell. This consists of an aluminium tank in which canned fuel rods of enriched uranium are suspended while heavy water circulates through the tank. This reactor will produce a maximum heat output of about 10,000 kW

accelerate beams of protons to very high energies, these being required to enable participation in research on the frontiers of nuclear physics. Attention is at present being concentrated on a new type of proton synchrotron accelerator for an energy of 6,000 to 7,000 MeV, with the object of producing about 100 times the intensity of the present American machines and of a new machine designed in the U.S.S.R. Particles would be accelerated in the gap of a ring-shaped magnet of about 5,000 tons weight and about 120ft in diameter, and would have to be given a preliminary acceleration to 5 or 10 MeV in a subsidiary machine. It is planned to incorporate a recently developed principle of focusing using what is known as the spiral ridge method, in order to obtain a considerable saving in the total weight of steel required. The site of this accelerator has not yet been decided though it might be at Harwell.

In discussing health and safety the report states that in the period under review there has been no single case of occupational toxicity, illness or death, or a single fatal accident.

Sales of radioactive isotopes have grown steadily during the year, the total value of the products sold being about £483,000. More than half of the total sales represented exports. Among new applications of isotopes have been the investigation of sewage pollution of beaches and a new method of borehole logging in which a neutron source is lowered into a pipeline at about one foot distance from a scintillation counter. The gamma rays detected by the counter depend upon the absorbing nuclides present in the strata and an analysis of the radiation will yield information on the nature of the strata.

During the year 167 students attended the normal four-week course at the isotope school and 104 attended special courses.

A considerable portion of the report deals with the relations between the Authority and industry. It is recognised that the history of atomic energy development in this country has brought about a situation where the great bulk of scientific and technical knowledge on the subject is concentrated in the public service, and that it is imperative for much of it to be disseminated in order that industry can play its full part in exploiting the commercial applications of atomic energy. The Authority regards this matter as one of its principle responsibilities at the present time and the several methods by which information is distributed are described in the report in some detail.

During the year the reactor school at Harwell gave training to staff from industrial firms in this country and in the autumn of 1955 the first courses were opened to overseas students. New buildings will be completed in the autumn of the present year to increase the capacity of the present school and plans are being formulated to provide a variety of courses.

An organisation has been set up by the Authority to enable particular firms to make use under licence of the patented inventions and developments it holds, and to enable its accumulated experience to be made available as widely as possible.

The final section of the report, which is devoted to international relations, mentions that a film showing the progress of construction at Calder Hall has been in great demand, both at home and overseas. Agreements for co-operation in atomic energy research and development have been made during the year with the United States, France, Israel, Denmark, Belgium and the Netherlands, and discussions concerning other agreements have been held with Norway, Sweden and Western Germany.

As Sir Edward Plowden said in opening the discussion on the annual report at a Press conference in London, the year that has just passed has marked the changing of nuclear power from being just a possibility in the distant future to something that is very much here with us now.

During the discussion it was made clear that there was to be no " credit squeeze " on atomic energy development and that the Authority was receiving all the financial help from the Government that it could gainfully use. In referring to recent reports that the reactors in the power plant programme are proving cheaper than had been anticipated, the impression given was that such savings would be achieved by making the stations somewhat larger than had been originally planned, about 250 to 300 MW, and employing higher temperatures in the coolant circuit. It was felt that no definite conclusions could be made until the Central Electricity Authority received its tenders from the four contracting groups later in the year.

Another Nuclear Power Station

THE South of Scotland Electricity Board announces that, after consultation with the United Kingdom Atomic Energy Authority, it has decided to construct in South Scotland a nuclear energy generating station. This station will contain two nuclear reactors of the graphite moderated gas-cooled type, capable of providing sufficient heat for a station electrical capacity of from 250,000 to 300,000 kW. The Board is planning to bring the first reactor into operation in 1961 and the second in 1962.

As nuclear generating stations require large quantities of cooling water for the turbine condensers, economies can be achieved by siting them on the coast and using sea water for this purpose as an alternative to the construction of large and costly cooling towers. Furthermore, this additional generating plant will be required principally to supply load centres in the west of the Board's area. Accordingly, several sites along the Ayrshire coast are at present being examined by the Board's engineers in order to determine their suitability for the construction of the proposed nuclear energy power station.

Specifications and invitations to tender have already been issued to four manufacturing groups which have been formed to supply and erect all the plant and equipment comprising a complete nuclear generating station, and tenders are expected to be received not later than the spring of 1957. The cost of the proposed nuclear station will be of the order of £35 million and as the station will need to be operated at a very high load factor it will provide approximately one-quarter of the total energy required in the South of Scotland District, resulting in a saving of nearly one million tons of coal each year.

In order to maintain adequate night load for this station and the other base load stations in South Scotland the Board is considering schemes involving the pumping of water to high level reservoirs during the night and at periods of light load, and using this water to generate electricity at times of peak load during the day. On completion of its plans the Board will put its proposals to the Secretary of State for Scotland for consideration under the relevant statutes.

Portable Tools in Chemical Works

Experience and Practice of Imperial Chemical Industries

IN 1945 Imperial Chemical Industries decided that there were in use within the company sufficient portable electrical appliances—that is, electrically operated appliances normally held in the hand while in use—to warrant a careful survey of the risks attaching to their use with a view to deciding on what voltage and system they should be operated. There were at that time in the various works, portable appliances working on 25 V, 35 V, 50 V, 110 V and 250 V single-phase a.c. and 110 V and 250 V d.c.

A committee of the company's electrical engineers was formed to consider this matter and their examination of the relevant electrical accident statistics showed that only an extra low voltage such as 12 V a.c. could give anything approaching absolute safety. At that time the company's standard voltage for a.c. handlamps was 25 and there was thus a natural tendency to consider this voltage for general use with portables. Little more consideration was needed to show that it was voltage to earth and not terminal voltage which had chiefly to be considered. It was known that one of the more serious risks was the use of trailing cables at mains voltage, as these could so easily be damaged and lead to a shock risk, quite apart from fire risk.

Physiological Considerations

As alternating current is in general use throughout the country, it is pertinent to limit the examination of physiological factors leading to a choice of "safe" voltage to its effects, although it may be noted that d.c. voltage has to be five times greater than the a.c. to produce similar physiological effects.

Published research data on tests carried out has shown that, at 50 c/s 97·5 per cent of the persons tested can "let go" of a tool with a current of 10 mA passing from the tool to earth through the body. The corresponding number of persons for currents of 14 mA and 20 mA are 50 per cent and 2·5 per cent respectively. It has also been found that the average resistance between hands and between hands and feet is about 3,000 ohms; from this it will be seen that current passing through the body would be 8 mA for 25 V to earth, and 18 mA for 55 V to earth.

These voltages correspond to tools operated at 50 and 110 V taken from the outer terminals of the secondary, centre-tapped to earth, of a transformer. In the former case, almost everybody can "let go," whereas, in the second, only about three persons in a hundred would be able to do so. Aside from consequential injury, such as falling from a ladder on receiving a shock, the inability to "let go" may lead to contraction of chest muscles and, when allied to the possibility of not being able to call for help, perhaps asphyxia.

An entirely safe voltage is not practical owing to technical factors in the design and operation of a portable appliance, so that a realistic compromise at the lowest satisfactory voltage has had to be made. The choice has been 25 V to earth, for which 50 V tools are now available in good variety and with a good operating efficiency.

It is contended that tools at 55 V from earth potential can be dangerous, whereas those at 25 V are virtually safe under nearly all conditions. This point has been confirmed by the Department of Scientific and Industrial Research which, in a U.K. Digest (No. 30H4), has stated that "contrary to common supposition, fatal accidents can arise from voltages of less than 100. Voltages up to 24 can be regarded as safe under almost all conditions."

In fact, physiologically, there can be no doubt in any quarter that 25 V is much safer than 55; only questions of expediency can lead to the adoption of 110 V tools under the mistaken impression that 50 V appliances are weighty, unsatisfactory in operation or maintenance, and hard to come by.

Site Conditions

While conditions in modern chemical works are kept to a high standard, it is the case that some plants are frequently hosed down and are liable to have rather a warm and, occasionally, corrosive and damp atmosphere, so that the body resistance may be well below the average. Such hot, damp conditions are found only in a minority of plants, but it was obviously not practicable to have different voltage standards in different plants of the same factory. The greater safety of ± 25 V (from earth) as compared with ± 55 V, decided its adoption throughout the company except where d.c. was available when ± 125 V d.c. could be used.

Work in a chemical plant sometimes necessitates working at a height and while many people can feel a 50 V a.c. shock with their hands in a normally dry condition, a very few can feel one at 25 V a.c. Feeling a shock while working at a height might cause involuntary movement and consequently a dangerous fall; thus 25 V to earth is a safer voltage than 55 V to earth from this standpoint.

Whilst these site conditions are those principally met with in chemical works, there are other situations, not of a chemical nature, which have equally arduous conditions. For example, although normal working conditions in a plant are considered to be good, maintenance work on equipment may have to be undertaken in hot, damp or otherwise unfavourable atmosphere and it is on such work that portable appliances are most commonly used.

Supply Arrangements

Consideration was given by the company's electrical engineers to the use of a higher voltage with earth leakage trips, but it was agreed that, although earth leakage trips may be reliable pieces of apparatus in clean, dry conditions, they are difficult and expensive to maintain in chemical works conditions. It was considered that while an earth leakage trip constituted an adequate safeguard as long as it functioned correctly, this could not be guaranteed even partially in chemical works conditions without quite excessive regular testing, while 50 V a.c. with earthed centre tap provides a continuous high degree of safety and needs no such excessive maintenance and testing.

It was therefore decided to supply a.c. portable apparatus at 50 V derived from the secondaries of fixed transformers, each with the secondary centre point earthed so that the shock risk was confined to 25 V a.c. from earth potential. The transformers employed have an earthed screen between primary and secondary windings. Naturally some doubt had been expressed at an early stage about the possibility of being able to purchase 50 V a.c.

tools at reasonable prices and at weights not greatly in excess of those of 250 V tools. It was soon found that certain manufacturers were willing to design and make 50 V a.c. portable tools which were hardly at all heavier and were not more than 10 per cent greater in price than their counterparts at higher voltages. They had also the advantages of more robust brushgear, commutators and windings. A wide variety of 50 V a.c. portable tools is now available. It should be noted that existing 250 V appliances can often be rewound for 50 V use.

It was felt that an increase in cost of 10 per cent was little indeed to pay for the increased safety of working on 25 V as compared with 55; this is particularly true when consideration is given to the necessity of using earth leakage protection with tools at 55 V a.c. to earth in damp conditions.

In the company's view, the use of portable tools at 110 V a.c. whilst insisting upon 25 V a.c. for handlamps, cannot be sustained because handlamps are so often hung up that they are a less continuous risk than portable tools which are always held in the hand while in use. 50 V can safely be used for tools and handlamps and, therefore, there is an overall economy compared with a dual voltage system such as 110 V for tools and 25 V for handlamps.

It is noteworthy that, whilst H.M. Factory Department considers the earthing of portable appliances at 110 V a.c. to be essential, it does not insist upon this being done on 50 V tools in similar situations. The company takes advantage of this dispensation, with a significant reduction in the weight of the flexible cable, an important factor towards comfort and safety in the use of a portable tool.

In addition to 25 V a.c. from earth potential, the company also recognises 125 V d.c. from earth potential as a satisfactory standard of almost equal safety.

Fixed Supply Installations

Present practice is to install fixed 50 V installations and to supply both handlamps and other portable appliances from them through 5 A, 15 A and 30 A plugs and sockets. In general, the length of flexible cable to each portable is limited to 15 yards; this limit was imposed, not on account of voltage drop, but because damage to long and perhaps badly kinked leads introduces a fire risk. To cater for the possibility of excessive voltage drop, transformers are designed for a secondary no-load voltage of 52·5; this allows, for example, the use of 25 yards of 110/·0076 cable with a load of 1,000 VA while keeping within ± 5 per cent of 50 V. In fact, it is the company's experience that a voltage which is 10 per cent low does not materially affect the operation of portable tools.

No portable transformers are used, but in cases where use of a portable tool is needed only occasionally on an extended site, plug-in transformers are permitted, as these become "fixed" (not portable) when in use. They are not allowed to have more than a 9in lead on the primary side.

All transformers used for supplying portables have the extra low-voltage terminals segregated so that a straying broken 250 V or 440 V primary lead cannot make contact with the 50 V side. The normal sizes installed lie between 500 and 2,500 VA but there is, of course, a low load factor and high diversity associated with circuits supplying portable electric tools. 120 VA transformers are also used for handlamps only.

The opponents of the 50 V system make great play with the loss of power due to voltage drop. There are now several thousand portable appliances in use by the company working on 50 V, and no complaints of lack of power are being received. There was undoubtedly some early apprehension on this account, but it has not survived the practical test of prolonged use. There is now in all responsible quarters within the company a firm conviction that the decision to adopt 50 V working has been amply vindicated.

Maintenance

Registration of all portable appliances is rigidly adhered to and the company's regulations call for the recall and examination of all such appliances at least every three months. This practice, in addition to ensuring the maintenance of such appliances in serviceable condition, has been found to guard against loss and indiscriminate use.

Before adopting 50 V a.c. for portables, weekly inspection was deemed necessary, so that a financial saving can be shown under this head.

Based on the company's many years of experience, there would appear to be no case against the use of 50 V for portable tools and the conclusions drawn from nearly ten years' operating experience with several thousand pieces of equipment are that the oft-quoted difficulties with this system are largely theoretical and that both tools and supply installations cost only about 10 per cent more than the much less safe 110 V a.c. system or the dangerous 250 V a.c. system.

The company's rules in respect of portable and transportable equipment are embodied in I.C.I. Engineering Codes and Regulations, Group C (Electrical), Volume 1.4. This is obtainable through the Royal Society for the Prevention of Accidents.

F.B.I. Overseas Scholarships

THE number of large-scale development projects being planned or actively under way in many parts of the world increased rapidly during the past year. This increasing tempo of development, states the annual report of the F.B.I. Overseas Scholarship Scheme for the year ended 31st March last, has accentuated the need for a constantly increasing supply of trained engineers and technicians, and it is therefore gratifying to report that the Scholarship Scheme, which helps to meet this need by giving practical training to graduate engineers from overseas, was considerably extended during the last twelve months.

The 100th scholar under the scheme arrived in Britain in February. By 31st March fifty-one scholars had completed their training and returned home; fifty-six scholars from thirteen countries were being trained in this country; and 126 further scholarships were on offer to countries of the Commonwealth, Latin America and the Middle East, including offers made for the first time to five Middle East countries which had not hitherto taken part in the scheme. The report mentions some of the development programmes planned in various countries, which provide new and growing opportunities for exports of British engineering products, and says that opportunities for training overseas engineers in Britain make a useful contribution towards building up goodwill and helping to make men in charge of overseas development projects aware of the range and quality of British engineering products.

The report describes the Scholarship Scheme and gives details of the three types of scholarship offered. The objects of the newly formed F.B.I. Scholars Association are given and there is a list of the 109 engineering firms now taking part in the scheme.

In a foreword, Sir Arthur P. M. Fleming, chairman of the F.B.I. Overseas Scholarships Committee, says that while the expansion of the scheme is gratifying, there are still many engineering firms which could readily provide excellent training facilities for these young men either alone or in association with others. The Federation will gladly co-ordinate arrangements between works to ensure progressive and properly balanced courses of practical training.

VIEWS on the NEWS

By REFLECTOR

DURING the war the Central Electricity Board organised a pool of electrical equipment from which electricity undertakings could replace bomb-damaged transformers, motors and other plant. This association of electrical equipment with pools is brought to mind by a Liverpool correspondent who tells me that samples of domestic electrical appliances have been purchased by the Russian Trade Delegation, now in Britain, from Littlewoods Mail Order Stores, Liverpool. The goods have been selected from a mail order catalogue in which the items include portable electric cookers, electric kettles, toasters, vacuum cleaners, food mixers and irons. The correspondent says that he was told by an official of Littlewoods that

> "all the Russian orders are paid for in sterling in the United Kingdom and are treated in the same way as normal orders from organisers of our Home Shopping Clubs. The goods are being despatched to the Moscow Chamber of Commerce."

* * *

I have previously referred to the enterprise of the South Eastern Electricity Board. Another example recorded in its magazine *SeaBoard* concerns the Horsham District, where public interest in road excavations of all sorts has been turned to account. Few spectators know what the work is required for, so the Board on a recent occasion provided a very detailed explanation and at the same time drew attention to its own services, in the following notice:

> "Here are a few facts about the work which we hope will interest you. The cable, which is a high voltage feeder, is being laid from the works at Stanley Street to a new transformer site at North Parade. At some future date it will be extended to reinforce the electricity cables in the West Horsham area and will ultimately go as far as Warnham Village. The cable is 0·1 square inches in section. It is insulated with 0·21 inches of paper, impregnated with oil. The lead covering keeps the water out of the cable, and it is then protected with two layers of steel tapes. When it is laid it is finally covered with a reinforced concrete slab to prevent it from being damaged. The cable costs approximately £1 10s per yard to buy and each joint costs £20 to make. When fully loaded it will transmit over 3,000 kW of electrical energy.
>
> "It is necessary to carry out all this work due to Seeboard's constantly expanding business.
>
> "If you have any electrical problems ask Seeboard."

* * *

To the construction engineer a generating station may be an impressive building but his description of it is usually prosaic enough. May I therefore commend an article in the *Pontefract Express* to the attention of those embarking on this task? Entitled "Majestic Features in Cathedral of Power" it opens, factually, with a statement that if the present rate of progress is maintained, heat, light and power will be surging into thousands of homes and factories before 1958 from the Ferrybridge "B" power station. At the moment, the writer says, the "vast organism has reached almost a consecrational stage." It is preparing to receive the three major installations, the three 100,000 kW turbo-alternators, boilers and transformers. "They are the composite trinity which will comprise the giant creator of power soon to sit enshrined at Ferrybridge. And preparations for enthronement are majestic." He goes on to say:—

> "It is the noble scale. The surge and sway of sweeping lines imply æsthetic dedication to the hidden god. A gothic sense of immensity impels an inward obeisance; the cathedral of power is taking shape."

The cooling tower straddles the road "like an enormous shrine." Fortunately it is some way off from the boiler house where "hangs the intimidating bulk of a coal bunker . . . udder-like in its enveloping maze."

* * *

Those who carry out installation work without the necessary qualifications are dealt with summarily in Canada. A correspondent living in Victoria, British Columbia, has sent me the following extract from a local paper:—

> "Keller, reportedly employed as an engineer for a chain grocery store concern, was arrested Monday by Chris Klawa, city electrical inspector, after Keller allegedly installed an electric range at 4130 S. E. Ash street. Klawa said the installation was definitely hazardous and Keller worked without a dealer's licence or an electrical service licence."

Found guilty of violating the city electrical code, Keller was sentenced to a $50 suspended fine.

* * *

The fact that automation in industry, in one form or another, dates back quite a time is underlined in a Post Office circular I have just seen. This points out that "TIM," the Post Office clock, has just completed twenty years of service during which period it has given the correct time to nearly 500 million inquirers.

* * *

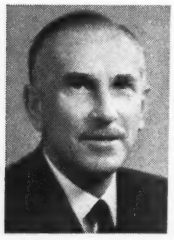
Wages and working conditions have changed a good deal in the past sixty years, as can be seen by comparing the report of the Labour Department of the Board of Trade summarised in the *Electrical Review* of 7th August, 1896, with that just published by the Ministry of Labour and National Service. The earlier document dealt particularly with hours of work, and the reviewer, who clearly had decided opinions on this subject, wrote:—

> "Opponents of the nine hours' system, when introduced, would have it that the hour saved would be wasted on drink. This has not proved to be the case, and therefore it must have had a beneficial effect on the physique of the mass of the people. The writer's observations are all to the effect that the workers of this country are more sober than they were, and statistics we believe confirm this. So far as tea is indicative of sobriety, the same habit is extending, and it would astonish men of twenty years ago could they see the change that has come over the country, not so much in the way of maudlin teetotalism, as in that of all round moderation."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the annual general meeting of the Scientific Instrument Manufacturers' Association held on 12th July the retiring president, Mr. C. E. T. Cridland, installed his successor, **Mr. G. A. Whipple,** M.A., M.I.E.E., F.Inst.P., in the chair for the year 1956-57.



Mr. G. A. Whipple

Mr. Whipple is chairman and managing director of Hilger & Watts, Ltd. He has been associated with the scientific instrument industry all his life and has strong family connections. His father was chairman of the Cambridge Instrument Co., Ltd., and president of S.I.M.A. on seven occasions. Mr. Whipple was educated at Gresham's School and Trinity College, Cambridge, and after two years' experience with British and German firms joined the Cambridge Instrument Co., being engaged for eight years mainly on high-speed cathode-ray oscillograph research. In 1939 he became a director of E. R. Watts & Son, Ltd., and was appointed managing director on the death of Mr. Frank Watts. In 1945 he became managing director of Adam Hilger, Ltd., and when the amalgamated firm of Hilger & Watts, Ltd., was formed in 1948 he was appointed chairman and managing director. Mr. Whipple is a past member of Council of the Institution of Electrical Engineers. He has concerned himself particularly with technical education and training and is a member of the governing body of the National College of Horology and Instrument Technology.

British Insulated Callender's Cables, Ltd., announces the appointment of **Mr. R. L. Packer** as regional manager, North-West Region, in succession to **Mr. J. L. Morley** who is retiring at the end of July.

Mr. Packer joined the former British Insulated Cables, Ltd., in 1929, after serving an apprenticeship with the Liverpool Cotton Association. Two years later he became a sales representative in the London branch, and in 1936 he was appointed branch manager at Southampton, a position he held until joining the Army in 1942. Demobilised in 1946 with the rank of major in the R.A.O.C., he rejoined the company in London, as a transmission engineer. In 1953 he was appointed London branch manager, holding this position until his present appointment.

Mr. R. L. Packer

Mr. R. E. Prickett

The company has appointed **Mr. R. E. Prickett** as branch manager, London, in succession to Mr. Packer. Mr. Prickett joined Callender's Cable & Construction Co., Ltd., at Anchor Works, Leigh, in 1932. Later that year he moved to Swansea to re-establish a branch office and remained there until 1936 when he was transferred to Tunbridge Wells to take over the management of the branch office there. He was commissioned in the R.A.F. and served in Coastal and Bomber Commands at home and abroad over a period of six years. On his release in 1945 he took over management of the Brighton branch.

Mr. G. F. Huddleston, Associate I.E.E., has been appointed the company's branch manager at Brighton in succession to Mr. Prickett. In 1928, after serving a student apprenticeship with the Brush Electrical Engineering Co., Ltd., he joined Callender's Cable & Construction Co., Ltd., at the company's Erith works. He moved to their Underground Contracts Department in 1929 as a contracts engineer and served in London and Birmingham, where he remained until 1935 when he joined the sales staff to become wiring development officer for the Midlands. After the amalgamation of Callender's Cable & Construction Co. and British Insulated Cables to form British Insulated Callender's Cables, Ltd., he joined the London branch, later being transferred to the London regional staff where, until his present appointment, he has had special responsibility for Government Department business.

Mr. G. F. Huddleston

G. P. Dennis, Ltd., announce the appointment of **Mr. S. C. T. Cox,** A.M.I.E.E., to the sales staff of their London office. Mr. Cox, who was educated at Kingston Grammar School and Wimbledon Technical College, was previously with Foster Transformers & Switchgear, Ltd., and Gresham Transformers, Ltd.

Mr. Keith Marten, J.P., has been appointed general sales manager of the London Electric Wire Co. & Smiths, Ltd., and its associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd., in succession to **Mr. A. B. Collins,** who retired on 30th June. Mr. Marten, who is a Freeman of the City of London, was educated at Rossall and served in the R.A.F. during the war, attaining the rank of wing commander. He sits as a magistrate for the County of Devon.

Sir Charles Lillicrap, K.C.B., M.B.E., D.Sc.(Eng.), has been elected president of the Institute of Welding for 1956-57 and was installed at the annual general meeting of the Institute held on 19th July. **Mr. J. Strong,** M.A., a director of British Oxygen Engineering, Ltd., has been elected vice-president.

The Board of Trade announce that the President has appointed Mr. B. A. Hopewell and Mr. W. T. Wren to be members of the **Council of Industrial Design.** He has reappointed Mr. W. J. Worboys, B.Sc., Ph.D., to be chairman, and Lady Sempill, A.R.C.A., Mrs. Alison Settle, Sir Colin Anderson and Mr. J. Cleveland Belle to be members on the termination of their existing appointments. Lady Sempill, Dr. D. S. Anderson, M.I.Mech.E., Mr. T. Coughtrie and Professor R. H. Matthew, C.B.E., A.R.I.B.A., have been reappointed members of the Scottish Committee of the Council on the termination of their existing appointments.

Mr. Leslie Gamage, vice-chairman and joint managing director of the General Electric Co., Ltd., has retired from the Council, on which he has served since its inception in 1945.

Mr. J. E. Finn, B.Sc., has been appointed to the position of chief control engineer for the North Eastern Electricity Board as from 1st September next. Mr. Finn gained his early practical training with A. Reyrolle & Co., Ltd., and his technical training at Sunderland Technical College. From 1932 to 1948 he served in various engineering capacities with the North-Eastern Electric Supply Co., Ltd., and at vesting day he was appointed protection engineer for the Tyne Sub-Area of the N.E.E.B. Since 1950 he has been attached to the Board's headquarters in the operation and maintenance section of the Chief Engineer's Department.

In a reorganisation of the Sales Department of Ransomes, Sims & Jefferies, Ltd., under the sales director, Mr. W. D. Akester, **Mr. J. S. Canning** has been appointed general sales manager. **Mr. R. B. Ransome** will handle the industrial (battery and fork lift trucks and machine tools) side of the business, both home and export, and will be assisted by **Mr. C. P. Seager. Mr. F. G. Newman,** who was the industrial home sales manager, has been appointed agricultural home sales manager.

The Minister of Fuel and Power has reappointed **Alderman T. Evans,** C.B.E., J.P., of Pengam, Monmouthshire, **Mr. R. James,** O.B.E., Wh.Sch., D.I.C., M.I.Mech.E., A.R.C.S., of Treforest, near Pontypridd, and **Sir Leighton Seager,** Bt., C.B.E., D.L., J.P., of St. Mellons, Cardiff, as part-time members of the South Wales Electricity Board.

Mr. H. A. Lewis, M.B.E., T.D., B.Sc.(Eng.), A.C.G.I., M.I.E.E., A.M.I.I.A., has resigned from Marconi's Wireless Telegraph Co., Ltd., to take up the appointment of personal assistant to Mr. E. J. Emery, managing director of the Domestic Electronics Division of Electric & Musical Industries, Ltd., with effect from 1st August. Mr. Lewis is the son of the late Mr. J. Lewis, who was general manager of the Marconi International Marine Co., Ltd. He took his degree at Imperial College, University of London, in 1933, and after two years with the B.B.C. as a student apprentice, he was appointed to the newly-formed television section of the Station Design and Installation Department. In 1931 he was commissioned to the Royal Artillery, T.A., and at the outbreak of war in 1939, with the rank of captain, mobilised an anti-aircraft workshop. Later he was sent on the first radar course at the Royal Military College of Science. After serving as technical staff officer on the headquarters of various commands, he was promoted to lieutenant-colonel in 1941 and appointed an assistant director at the War Office, where he was responsible for the formation and expansion of the branch of R.E.M.E. concerned with the installation, maintenance and repair of Army telecommunications and radar equipment. He was promoted to colonel in the T.A. in 1954.

Mr. H. A. Lewis

On his release from the War Office in 1945, Mr. Lewis returned to the B.B.C. as head of the television section of his old department, leaving there in 1948 to become manager of the newly-formed Broadcasting Division of Marconi's Wireless Telegraph Co., Ltd.

Crompton Parkinson, Ltd., have appointed **Mr. W. A. McNeill,** B.Sc. Tech., M.I.E.E., M.Amer.I.E.E., to the post of deputy chief engineer and deputy manager, Development and Research Department. In both these positions Mr. McNeill will be deputy to Mr. H. Astbury, M.I.E.E. The Development and Research Department is at the company's Chelmsford Works. Before his new appointment Mr. McNeill was chief engineer of Cooke & Ferguson, Ltd., Manchester (a Crompton Parkinson associate company) and he will continue to act as technical adviser to that company.

Mr. W. A. McNeill

Mr. W. H. Earwaker has been appointed a divisional director of Burt, Boulton & Haywood, Ltd. Mr. Earwaker, who was the Timber Trade Federation representative in the B.S.S. revision of Specifications 139 and 513 (Wood Poles for Overhead Lines), has for the past ten years been manager of the Telegraph/Transmission Pole Section.

Mr. F. S. Haggerson, of the United States, has resigned from the board of Bakelite, Ltd., for reasons of ill-health, and **Mr. G. C. Wells,** of the United States, has been appointed a director to fill the vacancy on the board caused by Mr. Haggerson's resignation.

Mr. D. L. Standley has terminated his appointment as personal assistant to the chairman and group managing director of the Teddington group of companies on taking up an appointment with Masson Scott & Co., Ltd., as assistant to the deputy chairman and managing director.

We learn as we go to Press that **Mr. E. W. Bussey,** C.B.E., is relinquishing his appointment as chairman of the Employers' Side of the Joint Negotiating Committees covering the electricity supply industry on 31st December next. He has held this appointment since his retirement as a member of the British Electricity Authority in 1952.

Mr. G. H. Sammons, M.I.E.E., sub-area engineer of No. 2 Sub-Area, Yorkshire Electricity Board, since 1948, retired at the end of July. He had served for forty-five years in the electrical industry, initially on the manufacturing side with Veritys, Ltd., and the General Electric Co., Ltd., at Witton, afterwards entering the supply side with the City of Birmingham Electricity Supply Department. There followed periods as test engineer with the Wolverhampton undertaking, as engineering assistant at Hampstead, and section mains engineer with Manchester Corporation Electricity Department. In 1934 he went to Grimsby as distribution engineer, and three years later was appointed deputy electrical engineer at Blackburn. From 1941 to 1945 he was borough electrical engineer at Dewsbury, and in January, 1946, was appointed borough electrical engineer and manager at Barnsley, a position he held until nationalisation.

Connollys (Blackley), Ltd., has appointed **Mr. F. J. Clifton** as manager of its southern sales office and stores, and **Mr. S. W. Graefe** as manager of the Midlands sales office. **Mr. M. Williams** and **Mr. E. G. Bennett** have been appointed representatives to take over their respective territories.

Mr. D. G. Lindsay, of Alexander Lindsay, Ltd., has been elected to represent the Electrical Contractors' Association of Scotland on the Electrical Fair Trading Council, in succession to **Mr. J. Y. Dick** (Oliver Melville & Co.), who has resigned.

The National Gas & Oil Engine Co., Ltd., has appointed **Mr. B. R. Cant,** general works manager, as works director, and **Mr. J. Smith,** chief engineer, as technical director.

Mr. J. A. Pinkney has been appointed to the sales staff of the Simplex Electric Co., Ltd., as a water heating sales engineer. Mr. Pinkney was educated at the Royal Hospital School, Greenwich, and Holbrook, and served in the Royal Navy in the Electrical and Torpedo Branch. Before joining Simplex he was with the Hotpoint Electrical Appliance Co., Ltd., as an area representative. Mr. Pinkney will be based on the company's London office at 26-28, Binney Street, W.1, and will operate in the Eastern, London, and South Eastern areas.

Mr. G. J. Reeves, A.M.I.E.E., has joined South Wales Switchgear, Ltd., as an additional representative in the London area. Mr. Reeves was for some time with Switchgear & Cowans, Ltd., and for the last four years has been in the Chief Engineer's Department of the North Western Electricity Board.

Mr. G. J. Reeves

Mr. W. Hartley, hitherto deputy station superintendent, Barnsley, has been appointed station superintendent at Barugh, Barnsley and Wakefield "A" power stations of the Yorkshire Division of the C.E.A. Educated at Queen Elizabeth Grammar School, Wakefield, and Wakefield Technical College, Mr. Hartley served his apprenticeship with Walter Robb, Ltd., electrical contractors. He entered the electricity supply industry in 1926 when he joined the Wakefield Corporation Electricity Supply Department and was engaged on sub-

station work until 1932. Moving to Wakefield "A" power station, he held successive appointments as switchboard attendant, shift charge engineer and maintenance engineer until 1951 when he was appointed deputy station superintendent at Barnsley.

The Council of the **British Electrical and Allied Industries Research Association** is advertising in this issue for applications for the post of director of research. The salary offered will be not less than £3,000 per annum initially.

Mr. C. K. Marklew, the author of the article in this issue on "Machine Tool Control," received his technical education at Nuneaton Technical School and the Birmingham College of Technology. He was employed in the electrical design drawing office of Alfred Herbert, Ltd., until 1949, when he became chief electrical engineer at the Red Lane Works, covering the technical and commercial aspects of the application of electrical equipment to machine tools. In September, 1955, he also took over more intensive work on research and development of new methods of machine control.

Mr. C. K. Marklew

Mr. N. Shackleton, A.M.I.E.E., A.M.I.Mech.E., has been appointed district manager of the Skipton No. 1 (Bradford) Sub-Area of the Yorkshire Electricity Board. He served as an apprentice and trainee electrical and mechanical engineer with the Nelson Corporation Electricity Department, with which undertaking he became assistant engineer in 1938. After service in the R.A.O.C. and R.E.M.E. in the last war he was appointed assistant consumers' engineer at Middlesbrough, and in 1948 took up the position of consumers' engineer at West Hartlepool. From 1949 to 1953 he was district commercial officer, Chester-le-Street and South Shields District, Wear Sub-Area, North Eastern Electricity Board, and since 1953 has been principal assistant engineer (commercial), No. 6 (Hull) Sub-Area of the Yorkshire Board.

On 10th July a cricket bat and tennis racket were presented to the best boy and girl at the Royal Commercial Travellers' School, Hatch End, by Mr. W. Candelatt, national chairman of the **Electrical Trades' Commercial Travellers' Association.** Mr. Simons and Mr. E. Stickley (vice-chairmen of the Association) also attended.

The Midlands Branch of the Association recently held a car treasure hunt through Warwickshire, when the winner was Mr. A. B. Frost, the branch chairman. Other prize winners were Messrs. A. Bishop, G. Morgan and J. Fordham. After a pleasant afternoon the members had tea at Henley-in-Arden.

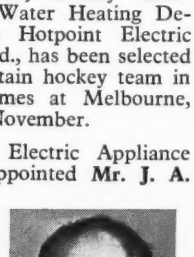
Sir Ben L. Barnett, K.B.E., C.B., M.C., B.A., Deputy Director-General of the General Post Office since 1949, retired on Tuesday last. Sir Ben was educated at Christ's Hospital and Trinity College, Cambridge, and was appointed assistant principal, G.P.O., in 1920, becoming principal in 1930. He subsequently held the appointments of telecommunications controller (1935-39), assistant secretary (1939-45), regional director (1945-47) and director of inland telecommunications (1947-49). Since 1954 he has been concerned exclusively with broadcasting and radio matters.

Sir Ben Barnett

Mr. A. G. Bennett, A.M.I.E.E., has joined RCA Great Britain, Ltd., at Sunbury-on-Thames and controls the High Fidelity Field Department. He was formerly with Marconi Instruments, Ltd.

Mr. Colin Dale, hockey international, of the Water Heating Department of the Hotpoint Electric Appliance Co., Ltd., has been selected for the Great Britain hockey team in the Olympic Games at Melbourne, opening on 22nd November.

The Hotpoint Electric Appliance Co., Ltd., has appointed **Mr. J. A. Saltmarsh** as market research manager. Mr. Saltmarsh is a Fellow of the Royal Statistical Society, a member of the American Statistical Association, the Market Research Society, and of the European Society for Opinion and Market Research. He served in the Royal Navy during the war and was market research manager with Erwin, Wasey & Co., Ltd., from 1945 until joining the Hotpoint company.



Mr. J. A. Saltmarsh

The **Standard-Kolster** annual fete was held at the Kolster-Brandes factory grounds, Sidcup, Kent, on 21st July. There were 20,000 visitors, including more than 4,000 staff members of the Standard Telephones & Cables, Ltd., and Kolster-Brandes associated companies, and their families, friends and guests. The fete included a variety show, funfair attractions, gymnastic shows, and model yacht and aircraft displays, and in the evening there was dancing. The prizes for the various events were presented by Mrs. P. H. Spagnoletti, wife of the chairman of the Standard Telephones and Kolster-Brandes companies.

OBITUARY

Sir Henry Guy. — The death occurred on 20th July, at the age of sixty-nine, of Sir Henry Guy, C.B.E., F.R.S., the well-known engineer, who from 1941 until his retirement in 1951 was secretary of the Institution of Mechanical Engineers, and who previously was for thirty years with the Metropolitan-Vickers Electrical Co.

Sir Henry received his technical education at the Cardiff College of the University of South Wales and Monmouthshire. He was the winner of the Bayliss Prize presented by the Institution of Civil Engineers and was awarded a Royal Research Scholarship and a Whitworth Exhibition. He entered the mechanical engineering side of the Metropolitan-Vickers Electrical Co. (then the British Westinghouse Co.) in 1910, being promoted chief engineer of the Mechanical Department of the company in 1921, and he was made a director of the Metropolitan-Vickers Electrical Export Co. in 1936, a position he held until 1941, when he was appointed secretary of the Institution of Mechanical Engineers, of which he was a member of the Council and (in 1938) was elected a vice-president of the Institution.

The late Sir Henry Guy

He was the author of many papers on technical subjects to this and other engineering bodies. On three occasions he served on the British delegation to the International Steam Tables Conference and was chairman of the British Committee. He was also at one time chairman of the Power Plant Section of the E.R.A. and a member of the N.P.L. Advisory Committee for Metallurgical and Engineering Research on Materials. He was elected a Fellow of the Royal Society in 1936 and in 1938 was elected to the Council of the Society.

Sir Henry was selected to act on the Advisory Council on Scientific Research and Technical Development, set up by the Minister of Supply in 1939, and he was chairman in 1947 of the Mechanical Engineering Research Board of the Department of Scientific and Industrial Research. He was made a C.B.E. in 1943 and was knighted in 1949. He retired for reasons of health in 1951.

Sir R. Geoffrey Ellis, Bt., formerly chairman of the Yorkshire Electric Power Co., died on 28th July at the age of eighty-one.

PARLIAMENTARY REPORT

IN the House of Lords the Earl of Munster, Minister without Portfolio, informed Viscount Thurso that the provisions of the Clean Air Act relating to the establishment of smoke control areas would come into operation before the end of this year, and the other parts of the Act, mainly affecting industry, would come into effect early in 1958. This was to allow time for improvements and alterations to plant that might be necessary in complying with the Act. The fuel-saving equipment which qualified for investment allowances under the Finance Bill this year included a number of items of special value in preventing air pollution. The Government could not undertake to vary its present monetary policy, but he was sure that the importance of both fuel economy and reducing air pollution was recognised by industry.

Viscount Thurso said the answer did not give an assurance that any drive would be put behind the production of the necessary appliances before the winter. It was of the utmost urgency to provide such credit and priorities as were necessary.

The Earl of Munster said that was the first he had heard that there was any likelihood of sufficient appliances not being available.

Aswan Dam

During the foreign affairs debate M.P.s welcomed the decision of the British and American Governments not to support the proposed Aswan High Dam project in Egypt. Mr. Philips Price said that if the dam were built as proposed it would ignore the rights of the Sudan, Uganda, Kenya and Tanganyika higher up the Nile. The Nile Valley should be treated as a whole by employing a number of schemes to deal with the waters coming out of Victoria-Nyanza, to use Lake Albert as a storage reservoir, and to build the Jonglei Canal through the great Sudd swamps, saving thereby large amounts of Nile water which now evaporated.

Mr. Selwyn Lloyd, the Foreign Secretary, said that recent developments in Egypt had made the Government doubt whether the scheme was any longer feasible. With their heavy defence and industrial commitments, the Egyptian Government would no longer be in a position to devote to the dam project the degree of priority necessary to secure its success. After consultation with the United States Government the British Government had decided that the economic premises on which their offer of assistance was based had ceased to exist. That did not mean, however, that they had lost interest in the future development of the Nile waters in the best interests of all who lived there.

Mr. Lloyd also referred to the work of the economic committee which was set up under the Baghdad Pact and said that experts were now meeting in Ankara to study the possibility of a joint development of the water resources of the Tigris and Euphrates. Good progress was being made with the atomic centre in Baghdad for training in the peaceful uses of atomic energy. The Government had promised financial aid for technical assistance and were considering what further help they could give in this sphere.

Nuclear Power in Europe

In the course of the same debate Mr. Anthony Kershaw, referring to the Euratom plan, said he hoped the Government would give it whatever help was in their power, but it must be realised what a great sacrifice it would be to go into Euratom lock, stock and barrel. We were far more industrialised and depended far more on power than any other country which was likely to take part in the scheme. If the nuclear energy available in Europe were distributed per capita among the countries of Europe, including Britain, our sacrifice would be much the biggest.

Mr. John Hynd said we should not think of our entering Euratom as a sacrifice, but as a contribution to the controlled development of the European community. For us to stand out would mean that West Germany, France, Belgium, Holland, Italy and Luxembourg would consolidate still further the development of a six-power federation with a common market.

The European Market

The Chancellor of the Exchequer, Mr. Macmillan, announced that at a meeting of the Organisation for European Economic Co-operation it was decided to study the possible forms of co-operation between the proposed Customs Union (the common market project) and other members of the O.E.E.C. He said the study group would take into account the possibility of creating a free trade area, to include the Customs Union itself, and other members of the O.E.E.C. If the study group held out any prospect of substantial progress being achieved on these lines before the end of 1957 they would be asked to press on with plans as quickly as possible.

At the same time the O.E.E.C. had been discussing the possibility of reducing tariffs on a range of goods which were called "European commodities." The countries concerned had not been able to agree on specific proposals but they had arranged that they should be studied further. It was decided that if the study group on the relationship of O.E.E.C. with the proposed Customs Union did not offer the prospect of immediate progress, the organisation would ensure that the European commodities plan would be completed without delay, so that an effort to get it into operation by 1st January, 1958, could be made.

[The nations working on the common market plan are Western Germany, France, Belgium, Holland, Luxembourg and Italy.]

Herbert Report

When the House of Commons discussed future business, Mr. Holt asked the Prime Minister if the House would have an opportunity to discuss the Herbert Report on the electricity supply industry before the end of the session. (The present session is expected to end early in November.) The Prime Minister said this would be discussed with the Opposition.

Boards' Finances

Referring to the electricity price standstill announced by the Central Electricity Authority in response to the Government appeal, Mr. Palmer asked the Minister of Fuel and Power whether it was not a fact that a number of Area Electricity Boards would be forced to have an adverse financial balance as a result of this policy. Was it wise or fair that hitherto prosperous national undertakings should be forced into a bankrupt position by pressure from above?

Mr. Aubrey Jones said that it was true that individual Boards would be involved in deficits but it would be quite wrong to suggest that these deficits were enforced by influence from above. Despite a widespread impression to the contrary, this action on the part of the Central Electricity Authority was entirely on its own initiative and was not the result of any prompting or suggestion by him or by the Government. What it did was compatible with the statutory requirement which was not that individual Boards should be in balance, but that the gross revenue of the undertaking as a whole should match its gross outgoings.

District Heating

Mr. Albu asked the Minister of Fuel and Power whether he would set up a committee to inquire into the economic possibilities of combined electricity generation and district heating by the use of small power stations sited near large new housing estates or new towns.

Mr. Aubrey Jones declined. He said progress in this field was not limited by lack of knowledge but by the high cost to the consumer even in areas where there was a concentrated demand for heat as well as electricity.

Mr. Albu asked if the Minister was aware that the economics of separate

electricity generation and district heating schemes were very different from those of combined schemes using back-pressure steam. This country was much behind European countries in using these new methods which saved much fuel.

Mr. Jones said he was aware that the economics of this subject were complicated. The fact remained that, rightly or wrongly, we had gone in for large power stations with consequent low operating costs. But that meant that if we attempted to distribute the heat the consequent distributing costs would be higher.

Monopolies Report on Electrical Plant

Mr. Kershaw asked the President of the Board of Trade whether he had yet received the Report of the Monopolies and Restrictive Practices Commission on the Supply and Exports of Electrical and Allied Machinery and Plant.

Mr. Peter Thorneycroft said that he received this report on 17th July. It would be laid before Parliament in due course in accordance with the provisions of Section 9 of the Monopolies and Restrictive Practices (Inquiry and Control) Act, 1948.

Imports from North America

Mr. Spence asked the President of the Board of Trade if he would make available a list showing the description of all manufactured goods imported from Canada and the United States under licence from his Department during the past twelve months.

A table showing recorded imports under Class D of the Import List for the twelve months ended May, 1956, was circulated in the Official Report. This included electrical machinery, apparatus and appliances to the value of £7,271,786 (Canada, £1,452,911; U.S.A., £5,818,875).

Science in Schools

In the debate on education several M.P.s asked the Government to make a greater provision for science teaching in the secondary and grammar schools. Mr. John Hall asked that part of the £97 million to be spent on technical education in the next few years should be devoted to providing up-to-date science and technical education facilities in the grammar schools. He told of a school, founded in the 16th century, using laboratories which were built in 1914 and were so inadequate that no form could have more than two periods in the laboratories in a week. This had a severe effect on the chances of students getting through to university as science students.

Sir David Eccles, Minister of Education, agreed that more technical education was needed at the top of the secondary modern schools and also in some grammar schools. The most fruitful line of advance, he said, lay in far closer collaboration between the secondary modern school in the last two years of the course and the further education which a boy or girl would take up after leaving school.

Mr. Vosper, Parliamentary Secretary at the Ministry, said there was a project for improving the facilities at the school Mr. Hall had mentioned.

Electricity and Rates

Mr. McKay asked the Minister of Housing whether he was aware that by taking electricity out of the rates and substituting a grant under Section 100 of the Electricity Act, 1948, local authorities were now suffering a financial loss of as much as 1s 4d in the £.

Mr. Sandys said he was aware of the general effect of Part V of the Local Government Act, 1948, to which the question referred. This and other rating problems were within the scope of the review of local government finance which was at present being undertaken.

Battery Railcars

In reply to Captain Duncan, the Minister of Transport (Mr. Harold Watkinson) said that the arrangements for starting a battery railcar service in Scotland were the responsibility of the British Transport Commission. The Commission's Scottish management would make an announcement in collaboration with the North of Scotland Hydro-Electric Board as soon as a suitable design had been worked out and the experimental coach was ready.

Capt. Duncan asked if the Minister recalled his earlier promise that he would find out when this would be done. Was he aware that the Hydro-Electric Board were only too anxious to supply the electricity for these battery railcars?

Mr. Watkinson said he was pressing the Commission and would let members know when the car was ready.

Road Lighting

Lieutenant-Colonel Lipton asked the Minister of Transport what steps he was taking to obtain uniform lighting on main roads. He said there were still far too many variations in lighting on main roads other than the trunk roads for which the Minister was responsible. A Government Committee considered this subject 21 years ago. Was it not time that the Ministry exercised some influence on local authorities to get them to deal with these variations, which did not help to reduce road accidents at night?

Mr. Hugh Molson, Parliamentary Secretary, replied that it was only over trunk roads that his Ministry had any control. The other roads were left to local authorities and he regretted that they were not all introducing lighting which was uniform.

Mr. Page asked whether the Government could not introduce legislation to ensure that there was uniformity.

Mr. Molson: "At present we do not propose to initiate any legislation on this subject. (Cries of 'Why not?') Such money as is available for work on the roads will be spent on road building—which is useful by day and by night. We are not disposed to spend on lighting more of any money which is available."

Mr. Shinwell asked whether the Minister was serious when he said that this involved the expenditure of money by the Government? Was it not a question of using influence with the local authorities to get some uniformity? Why raise the question of finance?

Mr. Molson said the Ministry used such influence that they could, but experience must have taught Mr. Shinwell when he was a Minister that where one was not able to make any financial contribution one's advice did not gain very much attention.

Hydro-Electric Resources

Mr. Ellis Smith asked the Minister of Fuel and Power if he would make a statement on the study that was being made on the prospects of harnessing the Severn estuary and river for hydro-electric power, and what similar prospects there are for other bays or rivers on the coast of Great Britain or Northern Ireland.

Mr. David Renton, Parliamentary Secretary, said the results of recent research into the Severn Barrage project were discouraging, and as far as the Government knew no other tidal inlet in the country offered any better prospects.

Volta River Scheme

The report of the Preparatory Commission on the Volta River project, published last week, states that the scheme as at present conceived is technically sound and economically feasible. The report explains that the project would increase the industrial potential of the Gold Coast both by making available large amounts of electric power for industry and by increasing the technical ability of the labour force of the country.

The parties concerned, the British and Gold Coast Governments, the British Aluminium Co., and Aluminum Ltd., of Canada, have each reaffirmed their interest in the project. The International Bank has been invited to back the scheme, which is estimated to cost £230 million, and will send a mission to the Gold Coast this year to survey the country's economy.

A lake would be formed by damming the Volta River, which would cover an area of almost 3,500 square miles, the largest artificial lake in the world. Production of fish in this lake would exceed the whole present production of sea fish and freshwater fish of the Gold Coast. Resettlement is not likely to cause any great difficulty, as the area which would be occupied by the lake is one of the most sparsely populated of the whole country.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Competition or Integration?

I FULLY agree with Mr. F. L. Waring's comments on the above subject. With respect to "Reflector" (*Electrical Review*, 13th July) I was prompted to reply also especially as he quoted Mr. Shinwell as an advocate of integration of the fuel industries. It is remarkable how long it takes an idea to sink in, especially with those whose business it is to obtain the best and economic results for the interests they represent.

"Reflector" says "I would like to know who would decide which particular jobs should be done by gas and which by electricity. (Some super Civil Servant I suppose)." He is quite right. It was put forward during Mr. Shinwell's period as Minister of Fuel and Power during 1946 and the answer given during that period was that it would not be an economical proposal to scrap existing facilities in the period of a suggested five-year plan covering the integration of the fuel and power industries of this country. "Reflector" says "Thus once again the former Minister of Fuel and Power resuscitates an idea which has lain dormant for a few months." He must have meant years.

As Mr. Waring states, the only sufferer is the nation—by excessive capital expenditure and inefficiently used fuel, the life blood of our country. As you may remember in my previous correspondence during the last five years on the utilisation of coal, the plan proposed allowed full scope for all interests to partake and enjoy greater prosperity than ever before and would also expedite automation and cut existing costs to enable us to lead the world in competitive production of manufactured goods.

Uttoxeter, Staffs. W. KNIGHT.

Log-Log Scales and Interest Rates

WHO was it who said "There is always a better way?" I am glad that my article under the above heading in the *Electrical Review* of 13th July has had the indirect result of introducing to a wider circle of readers (including myself) the closely related but better method described in Mr. Kendon's letter in your issue of 27th July for filling the gap below 1·1 in the "short" type of log-log scale.

Guildford. O. M. MEARES, B.A., M.I.E.E.

Safer Electric Blankets

MY attention has been drawn to the leaderette under the above title in the *Electrical Review* of 13th July last. As pioneers of this type of equipment some 25 to 30 years ago and with all these years of experience, we cannot accept your remarks. When the appliance is properly designed and made by skilled experienced workers the blanket can be quite safe. This is proved in our case by appliances being returned to us for overhaul after 20 years' use.

Furthermore, it is on record that in the last world war we beat the two greatest Governments in designing and supplying the safest and most efficient electrically heated flying equipment, adopted without question by the U.S.A. Air Force as standard by both Bomber and Fighter Commands.

It is clear that the original B.S.I. 2612 Specification to which you refer could have had no value as you state it had to be revised within twelve months; in fact, one can only assume it was one of those you mention, a real source of danger. We are not surprised as we refused to join the B.S.I. when invited for that very reason and the same holds good for the revision. Another point is, we have a large export business, where your comments could be misleading.

Regent's Park, London, N.W.1. A. V. SUMMERS, *Chairman*, Milliwatt, Ltd.

Scottish Industrial Development

THE President of the Board of Trade, Mr. Thorneycroft, speaking in a debate on Scottish industrial development in the House of Commons, said that activity in almost all branches of the engineering industry in Scotland remained at a high level. There had been further progress in the establishment of the electrical engineering industry and there were important proposals now for the production of contractors' plant. Scotland already had a significant and growing share in atomic energy developments and Scottish firms in many industries were contributing to the development of nuclear power. One of the smaller schemes of value to the remoter parts of Scotland was the electric lamp factory at Buckie.

In the Scottish Development Area the Government had made it plain that approval of further Government-financed building would be allowed only in exceptional cases of urgency and importance. They had agreed to build a 40,000 sq ft factory for Pye, Ltd., in North Lanarkshire, and he welcomed the development in this area of the electronics industry by this well-known British company.

Mr. J. C. George said that changes were taking place so rapidly and with such wide consequences that the House could not allow the various organisations, especially the South of Scotland Electricity and the North of Scotland Hydro-Electric Boards, to follow their own road. These two should be combined so that Parliament could direct their concepts along the proper road. It was ridiculous that at one and the same time we should be experimenting with atomic energy and peat. The time had come for a unified authority for the whole of Scotland. "The entire plan for fuel and energy needs to be supervised, otherwise we may make grave mistakes and be condemned by future generations," he said. "For example, I believe gas is on the way out. Someone ought to decide now whether it should go to the new towns or not."

Replying for the Government, Mr. J. Stuart, Secretary of State for Scotland, said the aim at the nuclear station to be set up in Ayrshire was to produce 300 MW by 1963. Then there was the big station at Kincardine, to produce 720 MW, and the 60 MW station at Barony, in Ayrshire, which, for the first time in Scotland, would convert into power something which had hitherto been unusable, washery slurry. These developments were all designed to save coal. The Government were pushing ahead with the peat station at Altnabreac because that might be a valuable coal-saver. Construction there had finished and the closed cycle turbine would be producing by June, 1957. There had been hitches in construction but, this being an entirely new project, that could not perhaps be helped.

He did not refer to the suggestion that the fuel and power industry in Scotland should be controlled by one authority.

INDUSTRIAL NEWS

Cables for Snowy Mountains Scheme

Pirelli-General Cable Works, Ltd., an associate of the General Electric Co., Ltd., has been successful, through the British General Electric Co. (Pty.), Ltd., of Sydney, in obtaining the contract for the manufacture in England and the installation in Australia of approximately 3,500 yards of 330 kV single-core 0·325 sq in copper conductor oil-filled lead sheathed cable for the T.1 power station at Tooma of the Snowy Mountains Hydro-Electric Scheme. The cable contract includes the design and manufacture of seven 330 kV single-phase cables for 340 A, grouped in two three-phase circuits with one spare cable, complete with terminations, supporting structures and all ancillary equipment. These will be the first 330 kV oil-filled cables manufactured in this country and follow the two supply and installation contracts carried out by Pirelli-General for 301 kV oil-filled cables for the Aluminum Co. of Canada, Ltd., at Kemano, British Columbia.

B.E.A.M.A. and Brussels Exhibition

The first post-war world exhibition is being held in Brussels from 17th April to 19th October, 1958. The theme will be "The Contribution of the Different Countries of the World to the Advancement of Mankind" and forty-four countries will be supporting the exhibition, which will cover an area 3½ times the size of Hyde Park.

The British Government is arranging an official United Kingdom Pavilion at an estimated cost of over £500,000. The remainder of the five acres allotted to the United Kingdom will be devoted mainly to a large British Industrial Pavilion organised by British Overseas Fair on behalf of the Federation of British Industries. This pavilion will cover all phases of British industry from raw materials, power and energy, engineering, automation right through to consumer goods. The B.E.A.M.A. Council has now approved the proposal that the B.E.A.M.A. should take the initiative in organising a collective exhibit (within the Power and Energy Section) to portray all aspects of the British electrical and allied manufacturing industry. It is anticipated that other kindred trade associations may wish to join in with the B.E.A.M.A. and this co-operation will be welcomed as it is desired to make the exhibit as comprehensive as possible.

Premium Bond Selection

The electronic random number indicator equipment, known as "Ernie," which is to be used to select winning bonds in the premium bond scheme which is to be launched by the Government on 1st November, was designed and will be built at the Post Office Engineering Research Station.

This machine has five major operational requirements. Each number will contain nine digits and each will be associated with a five digit sequential draw number. The second and third digits of the random number will be alphabetical characters, which means that for the second digit counting must be in a scale of 23 (I, O and U are not used). For the third digit only ten letters will be used, so that counting can be arranged as for "numerical" digits. The final output of the equipment will be presented on a page-printing teleprinter and also on gummed tape. Associated with the equipment will be a distributor which will route automatically each random number to the appropriate one of a maximum of 20 teleprinters installed at suitable points at which the registers of bonds will be kept.

Osram Cup Air Race

In an exciting finish, two competitors tied for the Osram Cup, presented by the General Electric Co., Ltd., in the third and final round of the Osram Cup Air Race which was flown in the National Air Races at Baginton Aerodrome, Coventry, on 21st July. Since this was the only trophy to be won outright, among the five competed for in the races, the G.E.C. decided to present a second cup similar to the original. The winners were Mr. T. G. Knox of Newcastle-on-Tyne, flying a Percival Proctor 3, and Mr. A. Barker of Shipley, also in a Proctor 3. After the racing both competitors received their cups from King Feisal of Iraq. Later they were congratulated on behalf of the G.E.C. by Mr. A. E. Page, manager of the Osram Lamp Department, and by Mr. F. E. Buckell, manager of the Aeronautical Department.

Winners of the Osram Cup Air Race at Baginton Aerodrome, Coventry, showing (left to right) Mr. W. H. M. Butcher, assistant manager, Aeronautical Department, G.E.C., Mr. T. G. Knox, Mr. A. E. Page, manager, Osram Lamp Department, Mr. A. Barker, and Mr. F. E. Buckell, manager, Aeronautical Department

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £190 10s od
COPPER, H.C. Electro	ton £310 10s od
Fire Refined 99·70%	ton £309 0s od
Fire Refined 99·50%	ton £308 0s od
COPPER Tubes ..	lb 2s 9½d
Sheet	ton £382 5s od
H.C. wire and strip ..	ton £326 0s od
LEAD, English ..	ton £114 10s od
Foreign	ton £113 0s od
MERCURY	flask £84 10s od
TIN, block (English) ..	ton £779 10s od
ZINC, G.O.B. Foreign	ton £95 5s od
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 3½d
Sheet	ton £294 15s od
Wire	lb 2s 11¾d
PHOSPHOR BRONZE Wire	lb 4s 5½d
PLATINUM	oz £34 0s od
RUBBER, No. 1 R.S.S. spot	lb 29¾d—30d

Cable for India

Wandleside Cable Works, Ltd., has received a further order from the Government of India, this time from the Punjab State Electricity Board for cable to the value of 26 lakhs rupees (approximately £185,000).

Electricians' Sick Pay

Twickenham Corporation is introducing a sick pay scheme for its electricians who will contribute 2½d in the £ of their wages and will be entitled to receive 13 weeks' sick pay in any one year.

Generating Plant for Malaya

A 12,000 kW turbo-generator set has been ordered from the Metropolitan-Vickers Electrical Co., Ltd., by the Perak River Hydro-Electric Power Co., Ltd., for whom a similar machine is already in hand at the Trafford Park Works. Both sets are to be installed

in one of the company's thermal stations at Malim Nawar. About 67 per cent of the electric power generated in Malaya is required by the tin mining industry, and about 89 per cent of this is supplied by the Perak Hydro-Electric Co.

The new turbo-generators will be generally similar to two 12,000 kW sets supplied to the Perak Company before the war, but are for higher steam conditions. Each will have a 3,000 r.p.m. single-cylinder turbine taking steam at 400 p.s.i.g. 800 deg F and exhausting to condenser at a vacuum of 27·75in Hg. Three-stage feed water heating equipment will bring the final feed water temperature to 271 deg F at 12,000 kW c.m.e.r. The generators will be of standard turbo construction wound for 6·6 kV three-phase 50 c/s; they are designed for a power factor of 0·68 and a kVA capacity of 17,650 to enable them to be used for line charging if required. The closed air-circuit ventilation system incorporates water-cooled air coolers mounted in the machine foundations. Main and pilot exciters will be fitted.

Large Australian Contract

A contract for the two largest steam generating sets yet ordered for installation in Australia has been placed with the English Electric Co., Ltd., by the Electricity Commission of New South Wales. The value of the contract is over £1½ million.

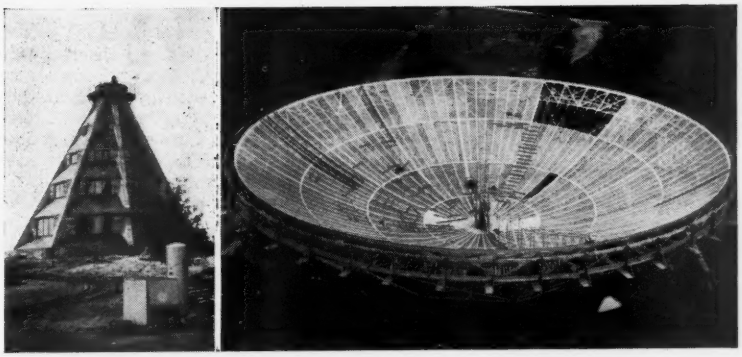
The turbo-generator sets, each of 100,000 kW, are to be erected in Tallawarra power station, near Port Kembla. Each turbine will be coupled to a hydrogen cooled alternator to generate power at 13,800 V. The sets will be built at the company's works at Stafford and Rugby.

The award of this contract to the English Electric Co. follows the placing of an order last February with the company by the Electricity Commission of New South Wales to build seven 330 kV transformers, the first of this size ever to be built in Britain.

Spanish Delegation's Visits

A delegation representing the Spanish Government are in this country as guests of the Board of Trade to study the development of nuclear energy. While in the Midlands on 19th July the delegation visited the works of the John Thompson group of companies at Ettingshall, Wolverhampton. The visitors were met by Mr. E. Thompson, chairman and managing director, and Mr. J. H. N. Thompson, deputy chairman and joint managing director.

Senor Don Juan Antonio Suanzes Fernandez, president of the Institute Nacionale de Industria, and Senor Don Jose Maria de Gaztelu, chief electrical engineer, headed the visiting party. They were accompanied by Senor Don Jose Sirvent Dargent, director of the Institute Nacionale, Senor Don Manuel Salis Martinez, Senor Don Ricardo Gimenez-Arneu, economic counsellor of the Spanish Embassy, London, and Mr. T. F. J. Lattimer, of the British Board of Trade.



A new radiotelescope is being built for the University of Bonn on Stockert Mountain, about 30 miles from Bonn. The reflector-scanner (right) will be 82ft in diameter and will rotate on concrete-bedded ball-bearing races on the concrete tower shown on the left

After inspecting the new John Thompson group research laboratories the visitors were shown a model of Britain's first full-scale fast breeder nuclear reactor, which is now under contract at Dounreay. During a tour of the factories delegates were shown atomic plant at its various manufacturing stages.

The Spanish delegates also visited the works of the British Thomson-Houston Co., Ltd., Rugby, on 21st July and among the B.T.H. officials who accompanied the party round the works were Mr. K. R. Hopkirk (chief mechanical engineer and director) and Mr. R. L. Chantrell (technical director).

Before leaving England the delegation will visit other companies undertaking work on Great Britain's atomic energy programme.

Encouraging National Service

George Ellison, Ltd., with their associated companies, Tufnol, Ltd., and Alfred Ellison, Ltd., have instituted a National Service benefits scheme, under which a sum of money in National Savings Certificates is put aside each month during the period of National Service. The accumulated certificates are handed to the employee upon his return to the company. While everyone who has been with the group for a year or more will benefit, at the basic rate of £1 per month, additional sums will be paid to those who have obtained an Ordinary or Higher National Certificate, or their equivalents. Those attaining non-commissioned rank or higher will have their monthly credits further increased.

Batti-Wallahs' Society

Timber would not appear to provide a subject of absorbing interest for an after-lunch address, but at last week's luncheon of the Batti-Wallahs' Society, Mr. I. Coughtrey, J.P., who spoke on "Our Native Trees," succeeded in endowing his remarks with a romanticism which held his listeners. He revealed many little known facts about our trees, and we shall, in our wanderings about the countryside, survey them with renewed respect and interest.

Mr. W. C. M. Couch (president) was in the chair, and Mr. C. N. Good (a past-president) proposed a vote of thanks to Mr. Coughtrey. Mr. T. C. F. Bigland (the "Mate") announced that, in accordance with custom, there would be no luncheon in August, the next being held on Thursday, 27th September, when the guest speaker would be Mr. T. C. Bailey (Shell-Mex).

Water Screen Contract

Marking a turning point in the design of screens for power stations are three large water screens, to be constructed by F. W. Brackett & Co., Ltd., of Colchester, under a contract recently awarded by the Central Electricity Authority. The company is to design, manufacture and install three double-entry drum type automatic water screens, as an entirely new development, for continuous day and night operations at the Northfleet power station under construction on the north bank of the Thames Estuary. Six identical screens, each measuring 44ft in diameter and 8ft wide, will eventually be installed at the new power station. Individually capable of screening 4,000,000 gallons of river water an hour for cooling the condensers of the power station, these screens will be the largest ever built.

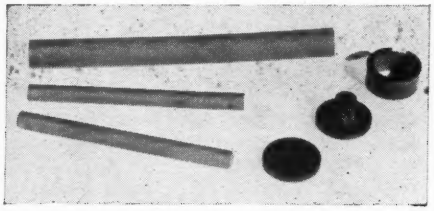
Colliery Year Book

The 34th edition of the "Colliery Year Book and Coal Trades Directory" follows the pattern of previous issues presenting in a convenient form the fullest information on the coal mines and allied industries. In addition to details of coal mines in Western Europe and the United States, full particulars of every coal mine in Great Britain and current information on the Ministry of Fuel and Power and the National Coal Board are included and the standard data, regulations and statistical sections have been brought up to date. The chairman of the National Coal Board, Mr. J. Bowman,

C.B.E., contributes a foreword. The Year Book is published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, price 30s net (by post 31s 6d).

Ferrite Materials

New ferrite materials developed by the Plessey Co., Ltd., Ilford, Essex, are providing the solution to many problems in the radio and electronics industries where miniature components with improved electrical properties are required. Basically, the ferrites are ceramic materials, the properties of which can be infinitely varied by differences of composition and manufacturing technique to give the optimum performance for specific purposes. This versatility enables grades of ferrite to be selected to suit a very wide range of applications which includes compact aerial units, r.f. filter units, T.V. components, frequency modulator reactors, square hysteresis loop and microwave applications. Ferrites have relatively high resistivities and as a result the eddy current losses are intrinsically low. This enables full advantage to be taken of the high initial permeabilities obtainable.



Plessey rods and filter core components made of ferrite materials

Mobile Radio for Malaya

Three Malayan authorities, the Police, Customs, and Fire Service, recently placed orders with A. T. & E. (Bridgnorth), Ltd., for v.h.f. mobile radio equipment for use in vehicles and patrol vessels under their control. All the equipment is standard six-channel 10 W RL type. The Malayan Fire Service, whose new headquarters building in Kuala Lumpur was due to be officially opened at the end of July by the Sultan of Selangor, has ordered ten sets, the Customs Department nineteen, and the Police fourteen. The total value of the orders is over £9,000.

Radio for Iranian Oil Pipeline

The National Iranian Oil Co. has awarded a £300,000 contract to Marconi's Wireless Telegraph Co., Ltd., for the supply and installation of a complete v.h.f. multi-channel radio system along the length of its new 600-mile oil pipeline from Abadan to Teheran. The order was gained for Britain against keen foreign competition. Equipment to be supplied includes 84 Marconi v.h.f. multi-channel type HM.181 equipments, together with a considerable quantity of telephone carrier equipment and diesel electric power plant. The four principal stations along the route are to be sited at Abadan, Ahwaz, Azna and Teheran, switchboards being provided at all these, with six circuits connecting the stations. All the other pumping stations along the line have radio-telephonic communication facilities with one or other of the main stations. In addition, a teleprinter circuit common to all pumping stations will be incorporated. In due course, available speech channels will be increased to eleven, while an additional twelve can be provided should occasion arise. The carrier equipment is to be supplied by the Telephone Manufacturing Co., Ltd., while the power supply units are by Auto-Diesels, Ltd. Ruston & Hornsby diesel engines will be used. The majority of the stations along the route will be completely unattended; each unattended station is self-contained, with its own diesel-electric power supply.

Trade Announcements

Kelvin & Hughes (Marine), Ltd., have opened a depot at 4, Central Road, Docks, Southampton. The engineer in charge is Mr. M. M. Smith.

The **Belmos Co., Ltd.,** announces that its London office has been moved to a new suite of rooms on the second floor of Columbia House, Aldwych, W.C.2 (telephone: Chancery 5953/4). The accommodation includes a showroom, where examples of flameproof and industrial motor control gear are displayed.

A new branch office has been opened by the **Skefco Ball Bearing Co., Ltd.,** of Luton, at Noverre House, Theatre Street, Norwich (telephone: Norwich 28949).

Arthur Ford, Ltd., announce that from 14th August their address will be Park Lane Works, Old Basford, Nottingham (telephone: Bulwell 27-8262).

Electronic Instruments, Ltd., has opened a new service centre in Bradford at 8, Duke Street. The centre is under the direction of Mr. A. C. Stewart, A.M.I.E.E.

The trade counter of **Falk, Stadelmann & Co., Ltd.,** is now at 5-11, Onslow Street, Farringdon Road, London, E.C.1 (telephone: Holborn 7654, ext. 43).

As from 28th August the London sales office and stores of **Le Carbone (Great Britain), Ltd.,** will be at 64, Finsbury Pavement, London, E.C.2. The telephone number (Monarch 8238) will remain unchanged, and the stores counter will continue to be available for the sale of carbon brushes.

Thomas French & Sons, Ltd., have moved their London office to Dundas House, St. James' Street, S.W.1.

Summer School for Electricians

What is believed to be the first full-time summer school for adult electricians in Great Britain was held at Llandaff Technical College recently.

At the opening ceremony, Mr. J. Cotterell, M.I.E.E., principal of the college, said that the school had developed from an idea of Mr. L. Howles, C.B.E., M.I.E.E., chairman of the South Wales Electricity Board. The idea had been discussed by Mr. Howles and the principal and after collaboration between the college authorities and Mr. Davies, Mr. Dalton and Mr. Faithfull, of the South Wales Electricity Board, the course was initiated. Mr. Robert E. Presswood, B.Sc., director of education for Cardiff, on behalf of the Education Authority, welcomed the students to the College. Afterwards, Mr. W. A. Gallon, B.Sc.(Eng.), M.I.E.E., deputy chairman of the South Wales Board, formally opened the school and Mr. Robert James, O.B.E., Wh.Sch., chairman of the college electrical engineering advisory sub-committee, spoke on the development of this special form of technical education.

Of the 91 applicants for places in the school, 25 had been chosen, 21 from the Area Board and four from the Generation Division. The first choice of students for the course was influenced in favour of those whose apprenticeship had been interrupted by war service. The curriculum was so arranged that the work covered was broadly that of the City and Guilds of London electrical installation course "B," together with specialised items required by local conditions, including both practical and theoretical work. In addition, special lectures and, where applicable, demonstrations were given, supplemented by visits to factories. The work of the course, arranged by the principal of the college, was under the control of two full-time tutors, Mr. Case and Mr. Fieldman, who were assisted by the following specialist lecturers: Mr. D. G. Dodds, Mr. Faithfull, Mr. Sutton (H.M. Electrical Inspector of Factories), Mr. G. J. Everett, Dr. Idris Davies and Miss Morgan. The specialist lectures included "Job Allocation," "History and Organisation of the Industry," "Fluorescent Lamps and Circuits," "Safety and Electrical Apparatus," "Electric Shock" and "Space Heating." In addition, films on electrical subjects and one on manual lifting and handling were shown.

Standardisation of Electrical Equipment

BY A SPECIAL CORRESPONDENT

THE ever-increasing importance of standardisation as an economic weapon to secure a higher level of living for the peoples of all nations was reflected in the activities of the technical committees of the International Electrotechnical Commission which met in Munich from 26th June to 6th July. Twenty-six of the 32 member-countries of the I.E.C. were represented by about 750 official representatives of the National Committees. The largest delegation (106) was that from the United Kingdom National Committee, under the ægis of the British Standards Institution. These were drawn from the appropriate B.S.I. committees and included representatives of manufacturers and users of electrical equipment (including electronics) and of the Central Electricity Authority and Area Boards. The delegation was headed by Col. B. H. Leeson (chairman of the British National Committee, and director of the B.E.A.M.A.) and Mr. H. A. R. Binney, C.B. (director of the B.S.I.).

France, Germany, Italy, the Netherlands, Sweden, Switzerland and the U.S.A. each sent 40 or more delegates, while Russia, Czechoslovakia and Yugoslavia sent about 20 each. Hungary and Poland were among the many other countries represented. A delegate from Roumania was present as an observer, pending the completion of the formalities for the election of that country as a full member.

Proceedings were opened by the Oberburgermeister of Munich and by Dr. R. Vieweg, president of the German National Committee, who recalled that this was the first time the I.E.C. had held a grouped meeting in Germany since 1913. Response was made by Dr. P. Dunsheath, president of the I.E.C. The delegates then settled down to work as members of the 38 technical committees, about half-a-dozen of which usually sat simultaneously.

Committee of Action

Two meetings of the Committee of Action were held under the chairmanship of the president. This Committee acts as the executive committee of the Council, and deals with matters of policy, finance and procedure. After referring to the loss suffered by the I.E.C. through the recent deaths of Mr. Maurice Leblanc (France) and Dr. S. Whitehead (United Kingdom) both of whom had been actively associated with the work of the Commission for many years, the president introduced Sir Roger Duncalfe, president of the International Organisation for Standardisation (I.S.O.), who is also president of the B.S.I. Sir Roger recalled that the I.E.C. and the I.S.O. had recently moved into new offices in the same building in Geneva, sharing certain office facilities such as duplicating machinery. While both bodies are autonomous, the former is affiliated to the latter as its electrical division and there is very close collaboration on all borderline subjects. Sir Roger foresaw still greater integration of the work of the two organisations, particularly in connection with future work on standards relating to nuclear energy and automation.

The accounts for 1955 showed an income for the year of 253,000 Swiss francs, about 900 francs more than the expenditure. The bulk of the income was received in the form of subscriptions from the National Committees, ranging from 3,000 fr. to 22,000 fr. The treasurer (Mr. Roth, Switzerland) also indicated that a revised budget for 1956 showed a deficit of 20,000 fr., while the budgets for the next few years had to take account of increasing demands on the resources of the Central Office and ever-rising costs, so that an immediate increase of 50 per cent in subscriptions from the National Committees was the only way in which the Central Office could hope to carry on and commence the building up of a reserve fund. The proposed increase was agreed upon, to come into effect for 1957.

It was reported that 25,000 Swiss francs had been collected in response to the appeal for voluntary contributions to the Charles le Maistre Memorial Lecture fund and that the expenses to date had amounted to 3,000 fr. The largest contributions were from the United Kingdom (5,000 fr.), U.S.A. (4,300 fr.) and France (3,000 fr.).

Survey of the I.E.C. Meetings in Munich

Co-ordination of Safety Rules. At the meeting of the Committee of Action in London in July last year a Sub-Committee on Safety Regulations was set up, under the chairmanship of Mr. H. A. R. Binney (United Kingdom), to follow closely the development of the work of the various I.E.C. committees as regards the formulation of safety requirements, and to promote progress. At the Munich meeting the sub-committee recommended that a number of directives should be agreed upon for the general guidance of I.E.C. committees dealing with standards for equipment "operated by persons deemed to be unskilled from the electrical point of view." These directives were to the following effect:—

(i) The specifying of safety features should be regarded as a matter of priority.

(ii) Clauses relating to safety features should, as far as practicable in any given case, be grouped together or in some other way be made distinguishable from the other clauses.

(iii) Safety features should be specified in as complete a form as practicable, and refuge should not be taken in vague generalisations. The requirements should be stated to the maximum possible extent by reference to well-described tests in preference to specification by constructional features.

(iv) The I.E.C. committees should as far as possible take into account the requirements specified by the International Commission on Rules for the Approval of Electrical Equipment (the C.E.E.) to see how far these can be translated into I.E.C. Recommendations.

These directives were agreed by the Committee of Action for submission to the relevant technical committees, but it was stressed, particularly by the United Kingdom delegation, that it was in many cases very difficult to distinguish between safety requirements *per se* and other features such as construction and performance which contribute to safety. It was stated, however, that in many countries legislation exists or is pending whereby the safety features of standards may be made mandatory and that, with a view to encouraging uniformity in practice as regards such features, every

effort should be made by the I.E.C. committees to agree on what clauses should be regarded as dealing specifically with safety requirements.

The Sub-Committee on Safety Regulations had also given consideration to the types of equipment on which new work should be started, particularly as regards safety. It recommended that, while priority might be given to the electrical equipment of machine tools and to domestic electrical appliances, the Committee of Action before deciding upon a future programme of work should ask the National Committees for their proposals, bearing in mind that the need for work to be started at an international level should be assessed on the basis of, (i) any difficulties at present being experienced in the import or export of equipment because of differences in national standards, and (ii) statistics of accidents caused by the use of particular types of equipment.

In accepting the Sub-Committee's report the Committee of Action decided to set up an Advisory Committee on Safety Rules to keep the problem under constant review. This Advisory Committee will be under the chairmanship of Mr. H. A. R. Binney (United Kingdom) with the National Committee of the German Federal Republic providing the Secretariat.

Advisory Committee on Electronics and Telecommunications. At the meeting of the Committee of Action in London last July, an advisory committee was set up to make recommendations on the co-ordination of the work of the various I.E.C. committees dealing with electronics and telecommunications and to maintain liaison with other interested international organisations. At the Munich meeting the Committee of Action adopted a report from the advisory committee which included the following recommendations:—

1. Steps should be taken eventually to establish a formal working agreement between the I.E.C. and the International Consultative Committees of the International Telecommunications Union.

2. Towards this end, discussions should take place between the I.E.C. Central Office and the specialised Secretariats of the C.C.I.s. In the first place these discussions should include a comparison of work at present being undertaken by the respective organisations which will indicate where co-operation can be most useful in the future.

3. The request for discussions leading up to such an agreement should be made by the Committee of Action of the I.E.C. to the Administrative Council of the I.T.U.

Chairmen of Technical Committees. The Committee of Action appointed Professor R. O. Kapp (United Kingdom) as chairman of the technical committee on power transformers, in place of Mr. A. G. Ellis, who had resigned because of ill-health, and Mr. E. Astor (France) as chairman of the technical committee on lamps and related equipment, in place of the late Mr. Maurice Leblanc. The Secretariat of both these technical committees is held by the B.S.I.

New Technical Committees. The Committee of Action had before it proposals for the formation of new committees to deal with the following subjects:—

(*a*) The designing and testing of line traps. This proposal arose from a report prepared by C.I.G.R.E. Study Committee No. 14 (transmission at high frequency). Although some National Committees of the I.E.C. considered that international agreement on current ratings and frequencies was urgent, the Committee of Action decided that in view of heavy commitments work on this subject should not be started by the I.E.C. at present.

(*b*) Ferromagnetically soft materials. The Netherlands National Committee had proposed that the properties of silicon iron and the methods of measurement should form the subject of an international recommendation. They pointed out, for example, that for rectifiers with highly saturated transformers the shape of the hysteresis curve within the saturation region was of importance and should be standardised within certain limits. The hysteresis curve is also of importance for regulating apparatus containing transducers which operate at a certain pre-magnetisation level, the important region of the curve in this case being the low field intensities. It was pointed out that a sub-committee of the technical committee on power transformers was already dealing with the method of testing sheet steel, and it was agreed that although the work of this sub-committee might not at present cover the requirements of the Netherlands proposal its report should be awaited before setting up a committee to consider the special magnetic properties of silicon-iron for special applications.

(*c*) Carbon brushes. Switzerland had proposed the formation of a committee to consider the dimensional standardisation of carbon brushes for rotating machinery, and although the practicability of achieving useful results had been queried by several National Committees it was agreed by the Committee of Action that a sub-committee should be set up under Technical Committee No. 2, Rotating Electrical Machinery, the secretariat being provided by the German National Committee.

Tesla Centenary Celebrations. The Committee of Action requested the president of the I.E.C. as its personal representative at the Tesla centenary celebrations to be held in Belgrade to convey the warm greetings of the I.E.C. on this occasion. The message referred to the very large measure in which the work of the I.E.C. for international agreement in the electrical field depended on the fundamental scientific work of Nikola Tesla which had been marked this year by the decision that the world unit of magnetic flux density in the Giorgi system shall be called the "tesla."

Atomic Energy. A statement to be submitted to the United Nations points out that the I.E.C. is already giving attention to the consequences which the development of industrial uses of atomic energy may have on the standardisation of electrical equipment, and is anxious to start work in good time on the new requirements with which, for example, cables, servo-mechanism components and measuring instruments will have to comply. On the other hand the I.E.C. considers that premature preparation of too definite specifications in those fields where technical developments cannot yet be foreseen sufficiently clearly should be avoided. There are, nevertheless, a number of items which should be dealt with without delay, and the I.E.C. is now starting work on electrical measuring instruments (especially of the electronics type) for nuclear reactors; electrical components of servo-mechanisms; and electrical measuring instruments employed in the use of radio isotopes.

Automation. It was agreed that all I.E.C. technical committees should be asked to consider whether their standards required extension to meet the needs of automation. It was suggested that this subject might form the basis of a future Le Maistre Memorial Lecture. Between sessions of the Committee of Action a 30-minute film showing examples of the application of automation was shown by the General Electric Co. (of America).

Future Meetings. A request from the Spanish National Committee that the invitation to hold the 1957 I.E.C. meeting in Madrid should be related to 1959 will be considered by the Committee of Action next year, as definite

On the platform at the opening meeting. Left to right: Mr. Roth (treasurer), Dr. Dunsheath (president), Mr. Ruppert (secretary) and Dr. Lanster (director V.D.E.)

plans are not made for meetings more than two years ahead. The Russian delegation extended an invitation for the 1957 meeting to be held in Moscow from 2nd to 12th July which was accepted on the proposal of Dr. H. S. Osborne (U.S.A.), immediate past-president.

An invitation from the Swedish delegation to hold a meeting from 1st to 10th July, 1958, in Stockholm, was also accepted.

Owing to the tendency for the number of committees taking part in the annual grouped meetings, and consequently the number of delegates participating, to increase, a heavy burden is imposed on the National Committee acting as host, thus limiting the number of countries which could receive the I.E.C. as their guests. It was agreed that no technical committee should meet unless there were assurances that adequate progress had been made in its work by correspondence or by working groups to the point where a meeting of the full committee was necessary to reach fruitful results. A number of directives to this end were drawn up by the secretary, Mr. L. Ruppert, and agreed by the Committee of Action.

Work of Technical Committees

Many of the 38 committees which met in Munich were sub-committees of main technical committees, under which headings they are grouped for convenience. The procedure for the preparation and approval of I.E.C. Recommendations is that a draft, after thorough discussion by a technical committee, shall be circulated to the National Committees for approval or comment under the six months' rule, which requires the National Committees to say whether or not they agree to the draft being published as an I.E.C. recommendation.

According to the comments received, a draft is either sent forward, unchanged, for publication or it is modified to meet some or all of the comments. In the latter case the amended draft is circulated for final approval under the two months' procedure. If the chairman of the technical committee is of the opinion that the weight of comment received is definitely against acceptance of the draft, he may rule that the draft be referred back to the technical committee for further consideration, after which a further draft must be circulated under the six months' rule and, if necessary, the two months' procedure.

Electric Motors (chairman: Professor Dahlgren, Sweden). This committee has for the past few years been considering the possibility of arriving at a single series of frame sizes of foot-mounted motors, but so far it has not been possible to reconcile the differences, many of them small, between the series based on inch measurements, as used in the United Kingdom, U.S.A., and a few other countries, and the series based on metric measurements as used in many Continental countries. Consequently, both these series were included in a report, published two years ago, in the hope that no new series of frame sizes would be introduced in any country. At Munich the Indian delegation submitted a proposal which was aimed at securing agreement on a compromise between the two series. This proposal took certain dimensions from the inch series and others from the metric series, the tolerances being arranged so as to secure interchangeability between the compromise series and both the other series. Although some delegations felt that the maintenance of both the present inch and metric series would still be necessary, it was agreed that the Indian proposals should be referred to a working group for detailed study.

Regarding shaft extensions, it was decided that for the present the two series of dimensions would be required. For the inch series some proposals submitted by the U.S.A. were agreed, and a list of metric sizes was compiled. Each shaft diameter was related to the maximum torque at continuous rating. Proposals to associate flange dimensions with torque or with axle height or with shaft dimensions were submitted by various countries. Such relationships did not receive general support, it being felt that they resulted in too many flange diameters for the horse-power range. The general opinion was that a reasonable number of flange diameters should be established, and a working group has been asked to investigate the possibility of standardising one series of flange dimensions.

Hydraulic Turbines (chairman: Mr. Logan Kerr, U.S.A.). This committee is preparing a test code for hydraulic turbines, and agreement was reached in principle on the framework (chapter headings and sub-headings) of the code. The Allen salt velocity method, the Gibson pressure-time method and the current meter method of measuring the quantity of flow were discussed in detail and final texts agreed. The drafting of the various chapters of the code was entrusted to a number of working groups which will conduct their work by correspondence during the next few months.

Steam Turbines (chairman: Mr. B. Pochobradsky, United Kingdom). This committee is preparing the requirements as regards turbines to be incorporated in a standard on preferred ratings of 3,000 r.p.m. 50 c/s turbo-generators. The requirements for the generators were completed some time ago by the technical committee on rotating machinery, but publication of the complete document has been held up pending the settlement of a few points relating to the turbine ratings. These points were cleared up in Munich and will be circulated for final approval under the two months' procedure. The document as finally issued as an I.E.C. Recommendation will also include sections dealing with 60 c/s turbines and generators, and these will be straight reproductions of the current American standards. The Committee is also preparing a revision of the I.E.C. Test Code for steam turbines. Several proposals were discussed in Munich and a further draft is to be prepared by the secretariat for discussion at the next meeting.

Aluminium (chairman: Mr. C. H. E. Ridpath, United Kingdom). Final agreement, after many years of discussion, was reached regarding the values to be included in specifications for aluminium-alloy electrical conductor wire of the Al-Si-Mg type, commercial hard-drawn

aluminium electrical conductor wire and commercial aluminium busbars. These specifications will now be referred to an editing committee and then sent forward for publication.

A draft specification for galvanised steel wire for the reinforcement of aluminium steel conductors has also been under discussion for several years. There has in the past been a reluctance on the part of many National Committees to agree to a specification for steel wire drawn after galvanising as an alternative to wire galvanised after drawing, but the persistent efforts of the United Kingdom delegation to have both types of galvanised wire recognised in an I.E.C. specification have now borne fruit. The text of the specification has now been agreed for circulation under the six months' rule.

Work is continuing on a draft specification for aluminium wire of tempers other than hard. The United Kingdom delegation expressed the view that the formulation of international specifications for several different tempers to meet all the national requirements would cause confusion in the minds of users, but they offered no objection to the collection of data from the National Committees, an examination of which would enable a decision to be taken as to whether the drafting of a few definite standards would be a practical proposition. Some discussion arose regarding the use of welded joints in wires and stranded cables. The chairman ruled that this was outside the present terms of reference of the committee, these being confined to the preparation of standards for the properties of the aluminium itself and of the steel core. It was therefore decided to circulate a questionnaire to the National Committees asking for their views on the desirability of starting work on a specification for cables for overhead lines.

Equipment for Electric Traction (chairman: Mr. M. Semenza, Italy). The meeting of this committee was immediately followed by a meeting of the Mixed Committee on Electric Traction composed of representatives of the I.E.C. and of the International Union of Railways (U.I.C.). All the decisions of the I.E.C. Committee were endorsed by the Mixed Committee. Draft specifications were agreed for circulation under the six months' rule relating to auxiliary machines on motor vehicles and to electrical transmissions of diesel vehicles. A report from the U.I.C. on the overloads to which fixed installations supplying power to traction systems are subjected was discussed and it was decided to submit some observations on the report to the I.E.C. technical committee on rectifiers, since the latter committee is also concerned with the same problem.

Preliminary consideration was given to some proposals for the extension of the I.E.C. specification for traction motors (I.E.C. Publication No. 48) to make it applicable to compound motors and to motors supplied with unsmoothed rectified direct current. The committee was not able to find time to consider the draft rules submitted by the U.I.C. for the testing of electric rolling stock on completion of construction and before being put into service. This matter will receive priority at the next meeting.

Insulating Oils (chairman: Dr. van Rysselberge, Belgium, in place of Professor Weiss, France, who was absent through illness). This committee has for many years been engaged on the evolution of a standard method of test for the ageing of oils. This has involved numerous exchanges of samples between laboratories in different countries for comparative tests. The results achieved have been encouraging and have shown that the proposed I.E.C. test gives better differentiation between various oils than that obtained hitherto by certain national test methods. With a view to meeting the wishes expressed by some National Committees that the duration of the test should be reduced without compromising the validity of the results, a group of experts has studied a number of suggested modifications in matters of detail, but precise proposals cannot yet be formulated. A general exchange of views took place in Munich, the experimental trends in various countries being described and questions asked regarding the testing technique worked out by the group of experts. A number of modifications were suggested with a view to improving the repeatability and reproducibility of the method, and these were all referred to the group of experts for investigation. The committee proposes now to widen the scope of its activities and to deal with other aspects of insulating oil specifications, and in particular with sampling and electrical properties. Close liaison will be maintained with the technical committee on solid insulating materials. A further exchange of samples was arranged for the purpose of making comparative tests of dielectric strength.

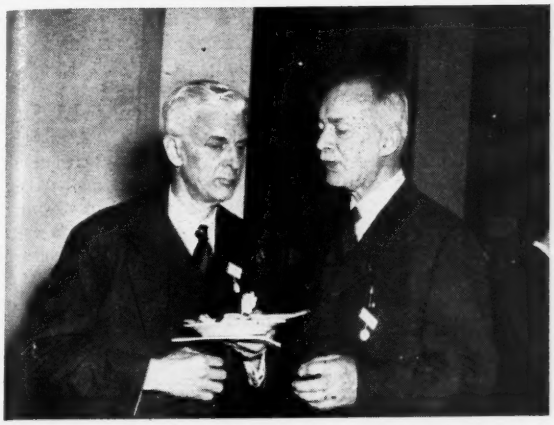
Radio Communication (chairman: Mr. P. Besson, France). A short meeting of this committee was held to receive reports from two of its sub-committees each of which had held meetings extending over several days. As a result a document on recommended methods of measurement of receivers for frequency modulation broadcast transmissions has been approved for publication, and a draft on radiation measurements will be circulated to the National Committees under the six months' rule.

Insulating Materials (chairman: Dr. R. Vieweg, Germany). This committee met to receive reports from seven working groups, as a result of which a document on method of test for volume and surface resistivities of electrical insulating materials has been approved for publication. A draft method of test for the determination of the insulation resistance of solid insulation materials was provisionally approved for circulation to the National Committees for comment. It is hoped that only minor comments will be received, in which case the document will then be circulated for approval under the six months' rule. A draft method of test for the tracking properties of insulating materials was approved for circulation under the six months' rule and the working group dealing with this subject will now turn its attention to the correlation between arc resistance and tracking under oil. Good progress was made on a draft method of test for dielectric constant and losses, but this draft is not yet ready for circulation under the six months' rule.

Work will proceed on a draft submitted by the B.S.I. on the subject of conditioning of insulating materials. The subject of conditioning is of interest also to other I.E.C. committees and several committees of the I.S.O., such as those dealing with rubber, plastics and textiles. To maintain liaison between all these committees a special co-ordinating committee has been set up.

Switchgear (chairman: Professor G. de Zoeten, Netherlands). This committee met to receive reports from its two sub-committees dealing with high-voltage and low-voltage switchgear, both of which sub-committees held lengthy meetings. As a result, drafts were approved for circulation under the six months' rule relating to co-ordination of rated voltages, rated breaking capacities and rated normal currents and to measurement of inherent restriking voltage.

The following drafts were agreed for circulation for approval under the two months' procedure:—Rules for the strength of insulation and rules for operating conditions and unit testing by direct methods. All the four above-mentioned drafts had been prepared by the sub-committee on high-voltage switchgear. This sub-committee decided



Mr. Clarence H. Linder (U.S.A.) talking to Mr. Langlois-Berthelot (France)

to include the subject of rules for load switches in its future programme of work. The sub-committee on low-voltage switchgear divided its draft into two sections, the first dealing with control apparatus for motors (including motor-starting circuit-breakers) and the second dealing with switchgear for distribution systems (including circuit-breakers, switches and isolators).

Semi-Conductor Rectifiers. This committee is preparing a specification for selenium and copper-oxide rectifiers, and several outstanding questions have been referred back to the National Committees for consideration. A working group was set up to consider the question of telephone interference voltages. A preliminary discussion took place regarding future work on single-crystal rectifiers, and the United Kingdom delegation undertook to submit a draft relating to complete equipment based on silicon and germanium.

Co-ordination of Insulation (chairman: Mr. Langlois-Berthelot, France). This committee is revising I.E.C. Publication No. 71 (recommendations for insulation co-ordination), and a number of amendments were agreed for circulation for approval under the two months' procedure, while other matters (including a list of impulse levels from 825 kV to 1,675 kV) will be embodied in a document for circulation under the six months' rule.

Arrangements were made for liaison with the technical committee on high-voltage testing techniques with a view to dealing with a number of outstanding matters including the following:—Standard reference temperature, humidity and pressure and corrections for variation of these; number of impulse tests considered necessary to indicate a withstand value of internal insulation tested separately; all conditions for wet tests.

Capacitors for Power Systems (chairman: Mr. R. Nordell, Sweden). This committee agreed upon two drafts for circulation under the six months' rule covering a specification for power capacitors for frequencies between 100 and 20,000 c/s and a guide for installation and operation. A specification for series capacitors for power systems was also discussed, but the draft is not yet ready for circulation for comment.

Primary Cells and Batteries (chairman: Mr. R. W. W. Sanderson, United Kingdom). A draft specification for primary cells and batteries was approved for publication and the standardisation of combined batteries, batteries for transistors and mercury cells was discussed, including a code designation and tests for the mercury cells. The question of the internal impedance of hearing aid batteries was also considered, and it was decided to ask for certain information from the technical committee on electro-acoustics which is drawing up a specification for hearing aids, after which a test programme on the batteries will be carried out by a number of National Committees. The future programme of the committee includes the standardisation of connectors and terminals.

Instrument Transformers (chairman: Mr. H. Leyburn, United Kingdom). This committee met for the first time and considered proposals prepared by the secretariat (the B.S.I.) for a revision of the I.E.C. specification for instrument transformers which was published before the war.

It was decided that the revised edition of the specification should be divided into several parts, namely: (1) measuring current transformers, (2) protective current transformers, (3) measuring voltage transformers, (4) protective voltage transformers and (5) capacitor voltage transformers. By dividing the work in this way, progress will be accelerated and the parts can be published separately if necessary. At the Munich meeting, discussion was mainly confined to Part 1, and good progress was made. A number of working groups was formed to deal with the few outstanding clauses. The U.S. National Committee undertook to draft proposals for Part 5.

The committee also discussed the question of terminal markings for instrument transformers in the light of the fact that terminal markings for a wide range of apparatus is being considered by a separate technical committee. The committee on instrument transformers expressed the view that terminal markings are an essential part of the revision of the I.E.C. specification on instrument transformers and made a recommendation to the Committee of Action that no proposals relating to terminal markings for instrument transformers which might be drawn up by any other committee should be published without the specific approval of the instrument transformer committee.

Electronic Tubes and Valves (chairman: Mr. T. E. Goldup, United Kingdom). A document dealing with outline gauges for sub-miniature tubes and valves was approved for publication as an addendum to I.E.C. Publication No. 67 (dimensions for electronic tubes and valves). A draft on the measurement of inter-electrode capacitances of tubes and valves was agreed for circulation under the six months' rule. Consideration was given to the problem of semi-conductor tubes and a programme of investigation was outlined to facilitate the initial discussions that will take place at the next meeting on definitions, symbols and measuring gauges.

Components for Electronic Equipment (chairman: Mr. E. F. Seaman, U.S.A.). This committee met to receive reports from several of its sub-committees and a report of a joint meeting of representatives of the main committee and of the committee on electronic tubes and valves. As a result four documents were agreed for circulation under the six months' rule, as follows:—Specification for fixed carbon resistors, Type I; specification for radio frequency cable (50 ohms), diameter over dielectric 7·25 mm; general specification for quartz crystal units for oscillators; basic parameters of printed circuits.

The following drafts were agreed for circulation for approval under the two months' procedure:—Specification for aluminium electrolytic capacitors; specification for fixed carbon resistors, Type II; amendments to general requirements and measuring gauges for radio-frequency cables.

The committee also approved a report on standard temperatures for testing, making recommendations regarding standard ambient temperature range for testing; standard reference temperature; and standard ambient temperatures for referee tests. This report also made

recommendations regarding the humidity and air pressures to be associated with the standard temperatures. It will be circulated to other I.E.C. technical committees in the hope that agreement can be reached on a co-ordinated set of recommendations for general application.

High-Voltage Testing Techniques (chairman: Mr. H. Puppikofer, Switzerland). The work of this committee is in its early stages and consideration is being given to a revision of the tables of sphere-gap calibrations and to other means of measuring high voltages.

Le Maistre Memorial Lecture

The second Le Maistre Memorial Lecture was delivered by Mr. Clarence H. Linder at the Rathaus on 29th June. The president recalled that the object of the lecture, instituted in 1953, was to perpetuate the memory of the outstanding services given to the I.E.C. by Charles le Maistre in the course of the 49 years during which he held office as general secretary, and at the same time to show how the I.E.C. could further contribute to the progress of international electrical standardisation.

Mr. Linder, who is vice-president (engineering) of the General Electric Company (of America), chose "Standardisation: Virtue and Necessity" as his subject. Experience teaches, he said, that in the fullness of time the necessity of co-operation will overtake us, so it is better to be virtuous ahead of time. This lesson applies to co-operation at every level, among individuals, groups of people, and nations and in all fields of effort—cultural, political and economic. Paradoxically, the greatest necessity is in fields where man is naturally most competitive, as in the electrical industry.

Customer requirements and conditions, said Mr. Linder, are, of course, a key force in all phases of the industrial process, but they create a dilemma: Can the customer's desire to buy exactly what he wants (very often something at least slightly different from what his neighbour has) be reconciled with the advantages of uniformity? The Commission has proved that advantageous reconciliation of differences in an enthusiastic community of interest is possible, particularly in two aspects of customer requirements. First, there is the customer's desire to know exactly what he can expect from the equipment he is buying. Here the I.E.C. has attained a high reputation for its work in the cause of common terminology and units of measurement, of established criteria of excellence, and of uniform tests to verify performance. A customer ought to be able to make his purchase with assurance that the manufacturer's commitment regarding performance will meet the specifications, irrespective of the point of use and the language spoken there. Standards in this sense literally become an international language of agreement—transcending differences in native tongues.

Secondly, the compromise between completely individualistic customer requirements and the advantages of uniformity has been the concern of this Commission from its beginning. Its original work to classify electrical machinery was undertaken for the mutual convenience of customer and manufacturer. The extension of customers' ultimate convenience—not always by any means his whim, demands increasing vigilance and co-operation from all associated with the industrial process.

After discussing the exchange of information which must precede the recommendation or adoption of any standard, Mr. Linder emphasised that any industrial enterprise must recognise that its continued existence in a highly competitive world depends upon continuing appraisal of its manufacturing methods and its designs in the light of rapidly changing technology, which can overthrow tradition and shift the customer's requirements, abruptly re-aligning the relative importance of available resources, as in the case of nuclear fuel for electric power, and determining the parameters of the cost-volume curve.

Summarising the case for standardisation, the lecturer referred to its principal objects as: meeting the requirements of customers; taking maximum advantage of the classical relationship between volume and unit cost; finding ways around the roadblocks of tradition and limitations of resources; and anticipating and coping with technological change. Attainment of these objects entailed unswerving devotion to two principles: first, co-operative effort for standardisation must rise above simple compromise of separate interests; it must seek instead to melt those interests into new common denominators which all parties can share enthusiastically. Secondly, all standards work must be dynamic, undertaken with full recognition that its ultimate end is to record what is judged best by common consent—but only until the new and better appears. The obligation must be undertaken for the economic betterment of all mankind—the only foundation upon which peaceful international relationships can be built.

Numerous visits to factories, power stations and other places of technical and other interest in and around Munich were well supported. The social functions included a banquet at the Congress Hall as guests of the German National Committee; a special performance of the opera "Il Seraglio" (Mozart) at the Prinzregententheater (followed by a reception given for the heads of delegations by the Government of the German Federal Republic); a reception at Schleissheim Castle; a Bavarian evening party at the Hofbräuhaus as guests of the V.D.E.; a steamboat party on the Starnberger See as guests of the Bavarian State Ministry of Trade and Tourism; and several alternative all-day excursions to the Bavarian Alps.

The proceedings were brought to an end at a farewell party at the Seehaus in the "English Garden." Speeches were, very appropriately for such an informal occasion, kept to a minimum, and the delegates were able to express individually to their German hosts and colleagues their thanks and appreciation of the excellently organised arrangements for the "1956 Munich Conference."

Circuit-Breaker Testing

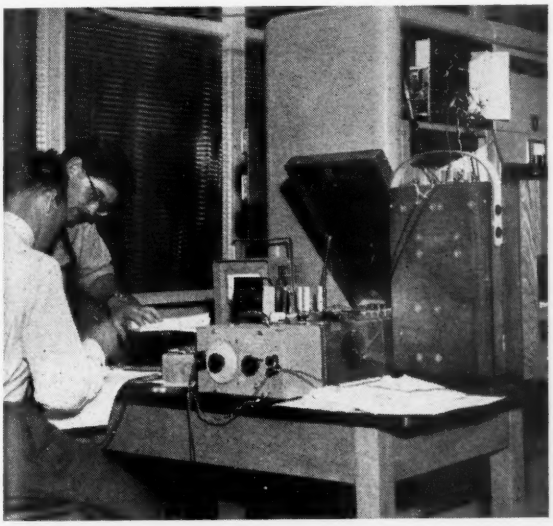
TESTS additional to those specified in A.S.T.A. rules and in British Standards are set out in a recent publication of the Association of Short-Circuit Testing Authorities entitled "Certificates of Rating with Special Reference to Supplementary Proving Tests of Circuit-Breakers." These tests are designed to prove circuit-breakers having particular characteristics, it being felt that unless they are conducted the certificate of rating will not be sufficiently comprehensive.

For the majority of circuit-breakers the certificates of rating which are issued under the A.S.T.A. seal to confirm the short-circuit ratings assigned by the manufacturer will consist, in future, of (1) Basic proving tests required by the appropriate Standard or A.S.T.A. rules, e.g. making and breaking capacity tests and short time current rating tests specified by B.S. 116:1952 or A.S.T.A. Publication No. 16, provided that for Class B circuit-breakers to B.S. 116:1952 the recovery voltage is not less than 67 per cent of the rated voltage for three-phase tests, and not less than 58 per cent of the rated voltage for single-phase tests; (2) Supplementary proving tests required at present by A.S.T.A. including such unit tests as may be needed to prove large circuit-breakers in accordance with A.S.T.A. Publication No. 15.

Industrial Research Establishment

WHETSTONE WORKS OF THE ENGLISH ELECTRIC CO., LTD.

LAST week we visited one of the more recently acquired factories of the English Electric Co., Ltd., namely, that at Whetstone, near Leicester. This must be one of the most interesting establishments in the country, because of the wide diversity of the research and development work and



Reactor kinetic simulator in use at Whetstone

the actual production work which is carried out there. The works is the headquarters of the English Electric Atomic Power Department and the Gas Turbine Department, as well as the company's Mechanical Engineering Laboratory.

The company started work at Whetstone at the beginning of 1955. The factory was originally built by the Government for Power Jets, Ltd., which at the end of the war was taken over by the National Gas Turbine Establishment. It was here that Sir Frank Whittle did much of his pioneer work during the war which led to the production of the first successful Allied aircraft jet engine. The works has expanded rapidly since the company took it over and there are now more than 1,000 employees. The majority of these are highly trained specialists and the work which they do is largely research and development.

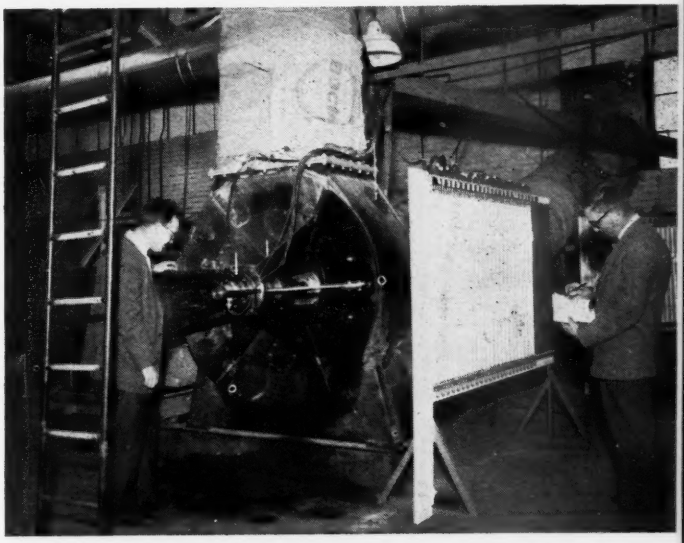
Dealing first with atomic power, it is of interest to note that Whetstone is the only complete nuclear power department of a heavy electrical plant group in the Midlands. The establishment is unique in this country in that, concentrated there in one centre, are all the research and development facilities necessary for the design of nuclear power stations. Much of the work involved is " classified "

This rig is for research on reactor fuel elements

and we were unable to see very much of what was going on during our visit. However, typical problems tackled at Whetstone are design in respect of uranium fuel elements, equipment to handle these fuel elements into and out of the reactor, methods of containing the growth of the graphite moderator in the reactor and, more important still, arrangements for controlling the reactor heat output under every conceivable condition of operation.

At present the department is engaged upon the design of the first commercial size nuclear generating station to be built by private firms for the Central Electricity Authority. The English Electric Co., Ltd., and its associates comprise one of the four groups formed at the invitation of the Government to design and build complete nuclear generating stations. Associated with English Electric in the nuclear power group are Babcock & Wilcox, Ltd., boiler manufacturers, and Taylor Woodrow Construction, Ltd., who look after the civil engineering side.

The work at Whetstone is closely co-ordinated with that



Half size development model of single-stage blower for circulating CO_2 coolant through nuclear reactor

at the Rugby factory. There is a development machine shop at Whetstone in which all the rig parts and models for development on the four prime mover products of the Rugby works is carried out. Some of these parts are tested at Rugby while others are dealt with at Whetstone, where test facilities are available to cater for the development of steam, gas and water turbines and large oil engines.

The Mechanical Engineering Laboratory investigates fundamental and long-term problems associated with the mechanical engineering designs of the existing prime mover products of the Rugby works. For this work the company has built up teams of highly qualified engineers, physicists and mathematicians and provided them with advanced equipment for experimental and analytical studies. The various sections are accommodated in separate laboratories dealing with problems in thermodynamics, heat transfer, fluid dynamics, lubrication, structures, mechanisms, controls and mathematics.

A water turbine structural laboratory is operated in the light rig shop, which deals with structural sealing and other problems related specifically to the design and manufacture of water turbines. Structural models are used which are precise scale models of the very large components used in the full scale turbine.

The Metallurgical and Chemical Laboratories are situated adjacent to the Atomic Power and Gas Turbine Departments. They consist of chemical, metallurgical, and creep test laboratories with their associated facilities for manufacture and preparation of specimens; there is also a welding research laboratory. Much of the scientific equipment in the laboratories has been specifically designed and adapted to problems associated with nuclear power and gas turbines.

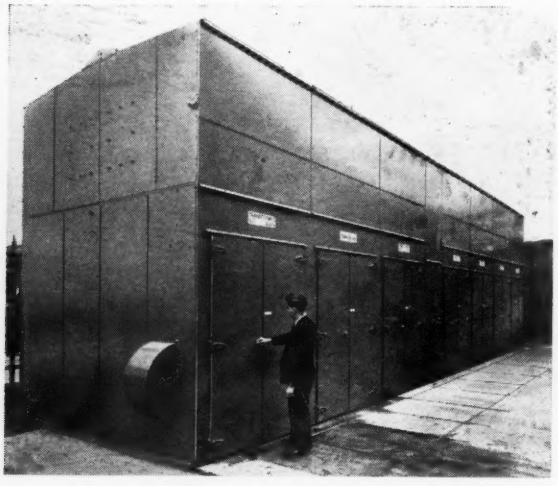
The company has three standard sizes of gas turbines in manufacture ranging from 2 MW to 20 MW. While the larger sizes of engine are manufactured either completely or in part at Whetstone, the facilities for prototype batch production of complete 2 MW gas turbines are of particular interest. Well-equipped development shops are available for testing the individual components of gas turbines, such as compressors, combustion chambers, fuel pumps, etc. Work currently in hand includes the combustion development associated with the burning of different types of grades of fuel.

Outdoor Metalclad Switchgear

Compact Installation at New Cardiff Substation

THE Taff Bank substation, Cardiff, commissioned last week, represents an important advance in the technique of electricity distribution and focuses attention on the practicability of installing 33 kV switchgear on restricted sites near the load centre. Hitherto, apparatus for such sites has been limited to switchgear housed in a special building and involving heavy expenditure on civil engineering works, the alternative being the use of open type outdoor substations, often impracticable owing to space considerations.

Development of 33 kV metalclad switchgear of the air-insulated type by the South Wales Switchgear Co., Ltd., for outdoor service has enabled the substation building to be dispensed with, resulting in a considerable saving in cost.



The South Wales Electricity Board's new substation at Taff Bank seen from the rear

The substation, which was formally commissioned by the Lord Mayor of Cardiff, comprises a seven-panel 33 kV 1,000 MVA outdoor air-insulated metalclad switchboard of the vertical isolation type. An important feature of the design is that there is no enclosed orifice insulation, while all busbar connections, cable and busbar plugs and sockets are supported on standard porcelain insulators. The switchgear forms part of the city's 33 kV distribution network and is intended to supply three transformers together with a number of feeders.

Similar equipment is to be installed at the Central Electricity Authority's grid substation now under construction at Cardiff West in addition to the 33 kV substations at Highmead and Fairwater, which are also fed from the Cardiff 33 kV network.

Quicker Installation

Before delivery to site the switchgear is completely assembled in the factory so that a comprehensive series of tests can be carried out. Only very limited dismantling, generally governed by haulage conditions, is necessary before the gear is delivered to site and this, in turn, enables the switchgear to be erected and commissioned in a fraction of the time necessary for the other types.

The equipment has vertically isolated and withdrawable breakers interlocked and factory built. The oil circuit-breaker is of the round tank type with splayed bushings to produce air clearance external to the breaker. The top deck comprising the busbar and feeder chambers is air insulated as also are the o.c.b. plugging members. The equipment is of unit construction and can be built up into multiple-unit boards and extended when necessary,

the unit centres being 6ft and the depth from back to front, 12ft.

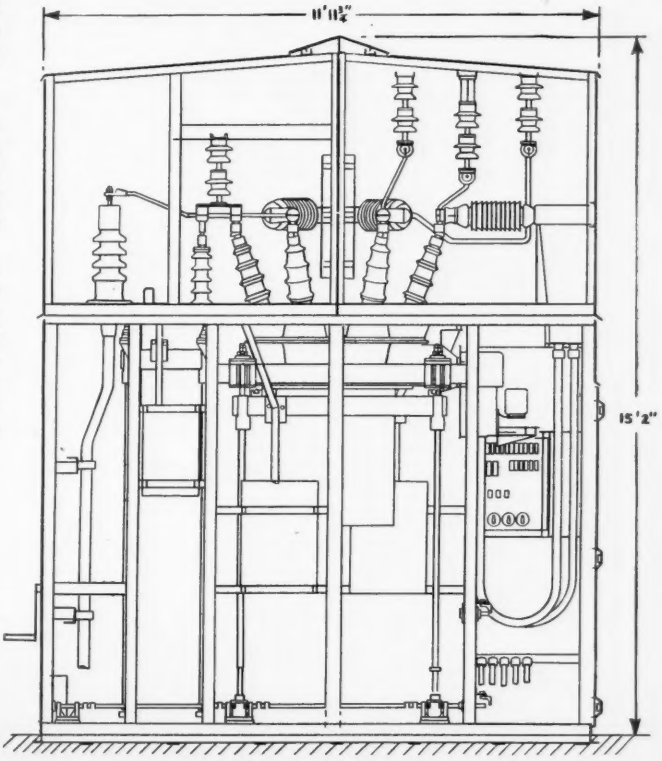
The busbar and feeder chambers are completely separated by a steel barrier and are freely ventilated through ample louvres with a separate canopy at the top of each chamber to permit free circulation of air at the same time as full weather protection. Insulation tests including impulse tests have been carried out in accordance with B.S. 116: 1952 for outdoor circuit-breakers. Interior heaters are fitted within the unit where necessary.

A feature of the unit is that the oil circuit-breaker can be inspected *in situ* in all weathers. A motor-operated mechanism is provided for raising and lowering the oil circuit-breaker to enable inspection and if necessary changing of contacts under cover and without removing the circuit-breaker completely from the unit.

Ring type current transformers are fitted on the bushings as required, and may be accommodated on the incoming, outgoing or both sides of the breakers, and operation can be by hand-wound spring, motor-wound spring or by solenoid closing mechanisms, all these being interchangeable with one another.

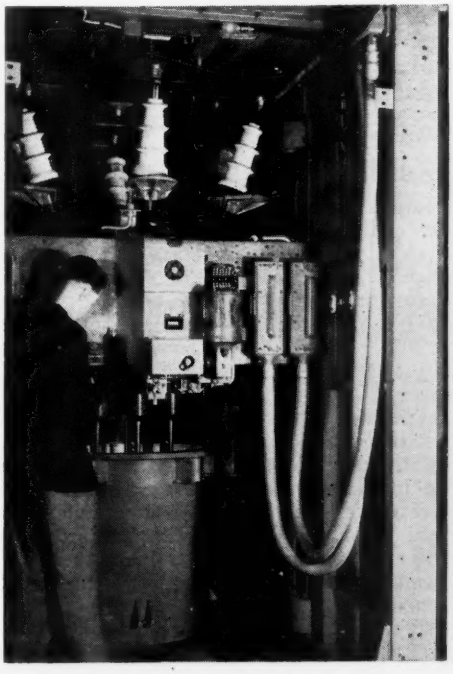
More space is available in each unit for control and relay equipment than is provided in the normal open type outdoor breaker control cubicle. The voltage transformer is housed within the unit structure and hand-operated raise and lower mechanism is provided for isolation. Space is available in all units for fitting voltage transformers at any time if required. There are no orifice insulators and all insulation exposed to air is porcelain. The impulse withstand of the equipment is 200 kV, and insulation creepage paths in the fixed portion are generally comparable with 44 kV outdoor practice.

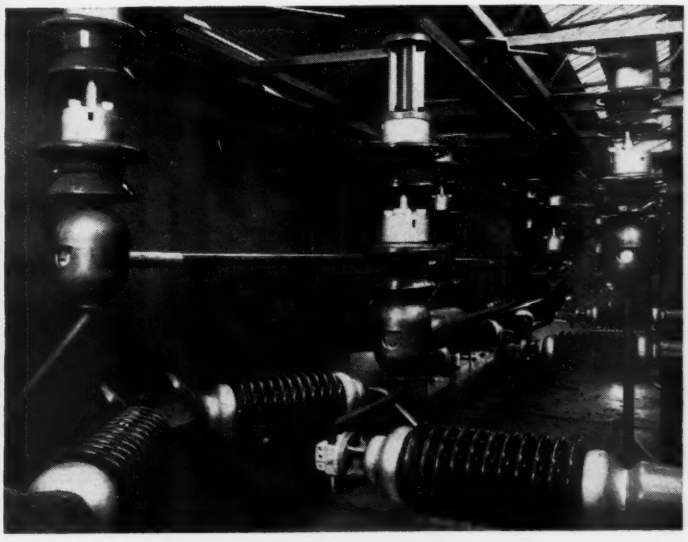
The switchgear has been successfully tested for the full series of tests to comply with B.S. 116: 1952. Certificates are held for 500 MVA, 750 MVA and 1,000 MVA ratings and a full range of tests has been successfully conducted from 0·5 per cent to 110 per cent of the 1,000 MVA ratings. The switchgear has also been subjected to a 5-sec through-fault current test equivalent to the 1,000 MVA rating.



Right: Cross-section view through a panel unit

Below: An oil circuit-breaker in the isolated position with tank covered and (right) the busbar chamber showing porcelain supports and glass insulating screens





Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

RESULTS are presented of experiments on automatic reclosing without control of synchronism in two parts of a power system supplied by several thermal power stations. These parts of the system are interconnected by a line which has to transmit up to 50 per cent of the power used in one part of the system.

The experiments were carried out at values of the transmitted power varying from zero to the possible maximum and with durations of the disconnection from 1 to 6·4 sec. In all the tests normal operating conditions were re-established when the parts of the system were reconnected. Except for the severest case (interruption for 6·4 sec at the maximum power transmitted), asynchronous operation did not take place, and the machines pulled into synchronism during the first cycle of oscillations. The voltage falls lasted only a very short time.

In the severest case mentioned, reclosing was carried out at a slip of 15 per cent and the period of asynchronous operation lasted 30 sec. The recovery of synchronism of the generators was due partly to their asynchronous torques, and partly to the action of the turbine regulators. Some influence must also be attributed to the fact that consumers' loads are shed under oscillations and that some of the consumers are disconnected for a short time by frequency-controlled load-shedding gear; the latter operated before the reclosing of the breakers and reconnected the consumers after recovery of normal frequency.—" Automatic Reclosing without Control of Synchronism," N. I. Sokolov and A. A. Khachaturov, *Elektrichestvo,* No. 9, pp. 64-67, 1955, in Russian.

Circuit-Breaking

Considering the multitude of systems and types of circuit-breakers now available, and also the still rising flood of publications dealing with all the aspects of the circuit-breaking problem, a simple, yet reasonably exact, analysis of the invariable features of the breaking process, contrasted with and supplemented by, the modifications introduced by the particular type of breaker used, form of short circuit cleared, system configuration, parameters and operating conditions, will always be valuable. It is well known that the earthing method used in the system also affects the circuit-breaking phenomena.

Despite the great amount of research work available in this field, a state enabling a concise analysis of the complex problem to be attempted has not been reached until fairly recently and, more than anything else, the concentration on the phenomenon of the post-arc current has eventually resulted in the necessary discrimination being made between arc-quenching and current-rupturing processes which must be kept strictly apart in theoretical considerations as well as in evaluating actual breaker performances. No-load characteristics and curves of dielectric recovery of breakers, together with either experimental or theoretical curves of post-arc current, are very convenient since they enable breaker performances under given conditions, or for assumed cases of fault clearance, to be predicted. The author shows that the analytical methods outlined can be applied to most of the existing breaker designs, however different their operating principles and arc-quenching methods may be. When it comes to current rupturing, these differences are considerably narrowed down, so that in the end a fairly similar treatment can be applied.—" Problems Relating to Circuit-Breaking and the Different Methods Used for the Purpose," L. Orgeret, *Bull. Soc. Franc. Elect.,* 7th Ser., Vol. 6, No. 62, pp. 123-140, February, 1956, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

Increasing V.T. Outputs

It will often be worth while to increase the output of an existing voltage transformer. This can be done in two ways, viz. by compensating the reactive component of the internal voltage drop, and by an appropriate adjustment of the voltage ratio and angle errors, in order to obtain the optimum utilisation of the range of permissible errors.

A device for compensating the errors of an existing transformer based on a theory of the physical origin of these errors (outlined in the paper) is described. It consists of a circuit comprising a triple-wound auxiliary current transformer, a capacitance and a resistance, connected to the secondary side of the voltage transformer. The current transformer is required to maintain the capacitance of the capacitor within economic limits, and the CR-circuit serves the double purpose of maintaining the voltage in the primary winding of the auxiliary transformer at a value suitable for a constant adjustment of the angle error, and of compensating the internal voltage drop in the leakage reactance of the voltage transformer.

A method is presented of determining the components of the impedance of the voltage transformer from results of the calibration and these results form the basic data for determining the main parameters of the necessary compensating circuit. The increases of output so obtainable vary from 130 to 280 per cent, according to the characteristics of the original voltage transformer.—" Increase of the Output of a Voltage Transformer by a Special Compensating Element," J. Hanus, *Elektrotech. Obzor,* Vol. 45, No. 2, pp. 57-63, 1956, in Czech.

Spark Quenching

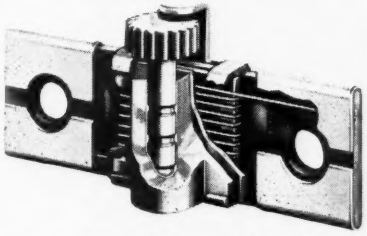
The suppression of switching sparks set up when inductive d.c. circuits are broken is often important. Shunting of capacitors across the break is mostly not efficient enough. A better method consists of shunting a rectifier across the inductance in the circuit by which the sparks are suppressed. The rectifier must be so inserted that it blocks the d.c. (in the inverse direction) and only the very small back-current can pass through it.

The principle of spark-quenching by rectifiers consists in the fact that the high voltage set up across the inductance at the instant of contact separation is buffered by the rectifier when its starting voltage is reached. The energy stored in the inductance is then harmlessly discharged through the rectifier. Breaking tests and measurements made on a 220 V contactor with an inductance of about 25 henry in the circuit confirm the effectiveness of rectifiers for spark-quenching. Different types and makes of rectifiers answered the purpose equally well.—" Spark-Quenching with Rectifiers," K. Hoffmann, *E.T.Z.(B),* Vol. 8, No. 1, pp. 9-11, 21st January, 1956, in German.

NEW ELECTRICAL EQUIPMENT

Overload Relays

Thermal overload relays designed to outlast the normal service life of the equipment they protect without loss of their high accuracy have now been made available in Great Britain by SQUARE D, LTD., 100, Aldersgate Street, London, E.C.1. These Class



Cut-away view of a Square D thermal overload relay

9065 relays are of the melting alloy type and have an inverse time characteristic which prevents their tripping on normal starting surges or harmless momentary overloads. They are available for ratings up to 100 A, 600 V a.c. or d.c.

The melting alloy overload relay consists of a block assembly with spring latch and contacts, and a detachable relay unit containing heater, melting pot, and ratchet wheel. Continued over-current through the heater unit raises its temperature and finally melts the alloy, allowing the ratchet wheel to rotate. The spring latch engaging the ratchet wheel is then released, causing the contacts to open. The relay can be reset a few moments later, after the alloy has resolidified. These relay units can be supplied in over 60 ratings.

Heating Panels

It is announced by H. G. POXON ENGINEERING, LTD., 1, 3 & 5, Northolt Road, Harrow, Middlesex, that their "Herga" electric heating panels now form the basis of a new wall-mounting heating system, with provision for mounting any number to form a neat and attractive unit. They provide radiant and convected heat and, owing to their relatively low surface temperature, are claimed to be completely safe.

The heating services are non-metallic and the elements are embedded and hermetically sealed in panels of tough insulating plastic. Fixing to the wall is by means of grooved hardwood supports, cappings and deflector shelves, enabling any number of panels to be mounted edge to edge in a continuous run. Each panel measures 16 by 22in wide, and when mounted the height of the shelf may be either 18½ or 24½in above the skirting board. Loading of the panels is 350 W. They are normally supplied in a natural mottled brown colour and can be painted on site with heat resisting paint to match surroundings.

Contemporary Lighting Fittings

A moderately priced range of contemporary lighting fittings suitable for the small home is now being manufactured by T. B. MORLEY & CO., LTD., Jameson Street, Hull. The range comprises four three-light pendants, one five-light cluster set and one three-light cluster set and two sets of matching wall brackets which can either be used as two-light or one-light fittings. The glassware is washable.

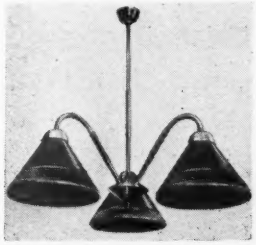
The fitting illustrated has a choice of two metal finishes, golden with ivory decoration or satin chrome with red decoration. The glassware is green or orange. The spread and depth dimensions are 21in and the price complete is £4 7s plus 17s purchase tax in the United Kingdom.

Spot/Repeat Welders

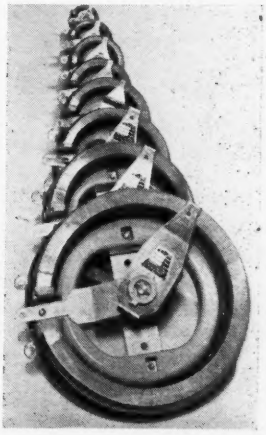
A new 40 kVA air-operated single and repeat spot welder, the first of a completely redesigned series comprising 40, 60, 100 and 150 kVA welders, has been introduced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2. A feature of the series is its versatility; based on a standardised frame, the major components such as pressure cylinder and lower arm arrangements are interchangeable. The 40 kVA welder has a throat depth of 12-36in and, like all the series, is fitted with a four-function timer controlling squeeze delay, weld-, hold- and off-time. This can be quickly removed as a complete unit for servicing and is fitted with a lock to prevent unauthorised adjustment once a sequence has been set. Primary current control is by an ignitron contactor and the foot switch incorporates two pressures—the first to close the electrodes and the second to initiate welds. When used for repeat welding, speeds of up to 180 spots per minute are possible.

Wire Wound Rheostats

The BRITISH ELECTRIC RESISTANCE CO., LTD., Queensway, Enfield, Middlesex, has recently extended its range of toroidally wound power rheostats by three new models of 225, 300 and 500 W rating, making the total range 25 to 500 W in eight sizes. By eliminating organic materials and using only metal and ceramics in their construction, they are able to withstand operation at high temperatures without deterioration and the silver graphite contact to the winding ensures stability of contact resistance for many years' operation. In addition to electronic equipment these rheostats are used as field rheostats for large machines, electric welding and similar applications where an infinitely variable adjustment is preferred to the stud type regulator.

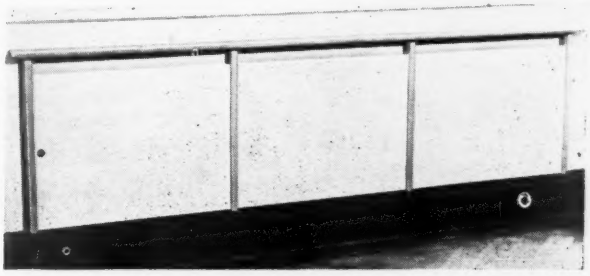


Above: Three-light pendant fitting No. 9719 (T. B. Morley)



Right: The complete range of British Electric Resistance rheostats from 25 to 500 W

Below: "Herga" panel heating system



DOMESTIC ELECTRICAL EQUIPMENT

Hair Dryers

APART from quickly drying the hair both safely and efficiently, the electric hair dryer is eminently suitable for several other home uses, including the drying of small laundered articles, paintwork, etc. From the feminine point of view it is almost an indispensable item of domestic electrical equipment and the present-day price of a visit to a hairdresser has no doubt been largely responsible for the increased sale of this type of apparatus.

The modern streamlined design of most hair dryers and the fact that the majority are made of plastic mouldings renders them completely shockproof and well-balanced for comfortable handling. Finger-tip control switches in the handle enable them to be manipulated with one hand and if use is made of a stand, now being offered by most makers, the dryer can be fixed in any desired position whilst leaving the hands free. Weight plays an important part in an appliance of this nature, the average being in the region of 2 to 2½ lb. Lightweight models, designed particularly for travelling purposes, weigh less than 1 lb, and these are obtainable in attractive leather cases.

Other extras offered are caskets, which also act as stands, complete with mirror and comb; built-in mirrors; and plastic hoods, designed to fit over the head of the user, thus concentrating the flow of warm air from the dryer. Apart from the few hair dryers which are powered by a.c. induction type motors, radio and television interference suppressors are refinements incorporated in many models, either as standard or as extras.

Manufacturer	Name or Model	Weight	Element Loading	Motor Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
BESTFRIEND ELECTRICAL CO., LTD., Diceland Works, Banstead, Surrey.	"Mitey"	1 lb	350 W	30 W	Lightweight, smallness in size	Ivory, pink or blue Bakelite	£2 9 6 (in carton) £2 12 6 (in wallet)	£0 10 11 £0 12 2
	"Permaster" Model "C"	2¼ lb	400 W	30 W	For professional use, rubber buffer strip	Chromium on copper body, Bakelite handle	£2 19 6	£0 13 0
	"Consort"	1¾ lb	400 W	30 W	Built-in mirror	Ivory Bakelite, red and blue switches	£2 17 6	£0 12 6
BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2.	"Duco Boudoir"	3 lb	500 W	50 W	Streamlined shockproof case. Stand 17s 6d extra plus 3s 9d P.T.	Walnut or peach Bakelite	£2 18 0 (walnut) £3 4 0 (peach) £0 5 6 (extra for T.V. suppressed models)	£0 13 0 £0 14 5 £0 0 8
BYLOCK ELECTRIC, LTD., 109, South Street, Ponders End, Middlesex.	"Dryad"	2 lb	400 W	25 W	Price inclusive of stand	Moulded in ivory semi-translucent plastic	£2 17 6	£0 12 6
	"Streamline"	2¼ lb	500 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Pressed metal body, chromium plated	£3 19 6	£0 17 5
	"Queen"	2⅛ lb	500 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	White Bakelite	£3 16 6	£0 16 10
	"Simoom"	2⅛ lb	500 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Walnut mottled Bakelite	£3 9 6	£0 15 3
	"Zephyr"	2¼ lb	500 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Metal body sprayed in lavender, turquoise or blue	£3 9 6	£0 15 3
	"Simoom Gem"	2¼ lb	500 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Moulded body in pastel colours	£3 9 6	£0 15 3

1. Electrothermal "Solis" 105. 2. Electrothermal "Solis" 54. 3. Bestfrend "Consort." 4. Bestfrend "Mitey." 5. Brown Brothers "Boudoir" model

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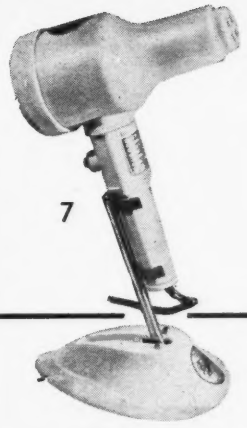

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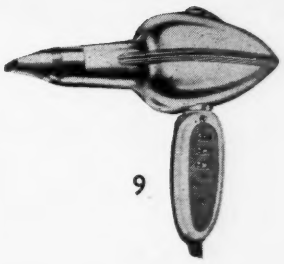

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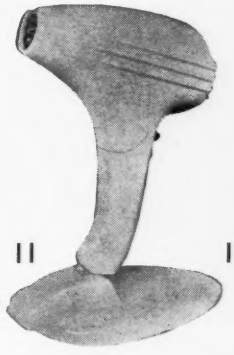

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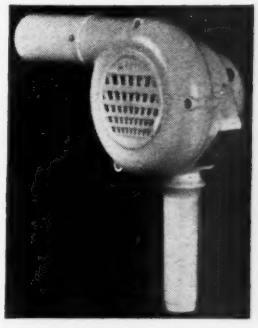

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6. *Bylock "Dryad."* **7.** *Bylock "Queen."* **8.** *Falk Stadelmann U.95731 lightweight model.* **9.** *Fransen "Forfex."* **10.** *C.W.S. "Minor."* **11.** *G.E.C. DM.395.* **12.** *L. G. Hawkins "Supreme"*

Manufacturer	Name or Model	Weight	Element Loading	Motor Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley, Worcs.	"Minor"	2 lb	400 W	50 W	—	Black and ivory	£3 3 2	£0 14 3
ELECTROTHERMAL ENGINEERING, LTD., 270, Neville Road, London, E.7.	"Solis" 54	1½ lb	400 W	—	With stand, suppressed	Ivory plastic	£2 15 9	£0 12 7
	"Solis" 97	1¼ lb	350 W	—	Unusual tubular design, suppressed	Ivory plastic	£3 6 4	£0 14 11
	"Solis" 99	1½ lb	210 W	—	Unusual tubular design, fitted waving comb, suppressed	Ivory plastic	£6 17 9	£1 11 0
	"Solis" 105	1¾ lb	550 W	—	Stand and mouthpiece extra, suppressed	Ivory plastic	£3 16 0	£0 17 1
	"Solis" 106	1¾ lb	750 W	—	4-heat control, stand and mouthpiece extra, suppressed	Ivory plastic	£4 18 0	£1 2 3
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	"U.95731"	1 lb	350 W	30 W	Available in leather pouch for travelling, suppressed.	Blue, pink or cream	£2 12 6	£0 12 2
JOHN A. FRANSEN, LTD., Northwood Hills, Middlesex.	"Forfex"	2 lb	720 W	80 W	Built for professional use, cold plus 3-heat air control	Maroon	£8 11 11	£2 1 3
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	"DM395"	2 lb	515 W	35 W	Radio and T.V. suppressed. Stand 16s extra plus 3s 6d P.T.	Cream plastic	£4 4 0	£0 18 5
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	"Supreme" L.G.H.95722	2 lb 6 oz	500 W	50 W	Radio and T.V. suppressed. Hair drying attachment £1 13s 4d extra plus 7s 4d P.T. Stand 16s 6d plus 3s 7d P.T.	Ivory Bakelite	£4 11 5	£1 0 0

HAIR DRYERS . . . . . *continued*

Manufacturer	Name or Model	Weight	Element Loading	Motor Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
HILLMAN ELECTRIC MOTORS, LTD., 2-3, Northwold Buildings, Northwold Road, N.16.	"Hillman"	1 lb 12 oz	500 W	20 W	—	Ivory or cream	£3 0 0	£0 12 9
MORPHY-RICHARDS, LTD., 6, Conduit Street, London, W.1.	"H/I"	1 lb 11 oz	400 W	25 W	Capacitor induction motor, heater cut-out switch. Stand 5s extra plus 1s 1d P.T.	Ivory plastic	£2 14 6	£0 11 10
ORMOND ENGINEERING CO., LTD., Rosebery Avenue, London, E.C.1.	"E.1022"	2 lb (3½ lb in casket)	500 W	50 W	Stand, mirror and comb	Walnut (*a*) or ivory (*b*)	£2 18 0 (*a*) £4 3 0 (*a*) (in casket) £3 3 0 (*b*) £4 10 9 (*b*) (in casket)	£0 12 9 £0 18 2 £0 13 10 £0 19 11
PIFCO, LTD., Watling Street, Manchester, 4.	"Pifco" 1050	2 lb	500 W	50 W	Stand 18s 6d plus 4s P.T. Hood 8s 1d plus 1s 10d P.T. Case £1 13s 4d plus 14s 7d P.T.	Ivory plastic	£3 3 0	£0 13 9
SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4.	"H.632"	2 lb (3½ lb in casket)	450 W	50 W	Available in casket including comb and mirror	Walnut (*a*) or ivory (*b*)	£2 18 0 (*a*) £4 3 0 (*a*) (in casket) £3 3 0 (*b*) £4 10 9 (*b*) (in casket)	£0 12 9 £0 18 2 £0 13 10 £0 19 11
SIROMA ENGINEERING CO., LTD., North Acton Road, Harlesden, N.W.10.	"HD20-R"	2½ lb	450 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Walnut Bakelite	£3 3 6	£0 13 11
	"HD30-R"	2½ lb	450 W	50 W	Stand 17s 6d extra plus 3s 10d P.T.	Peach plastic	£3 9 6	£0 15 3

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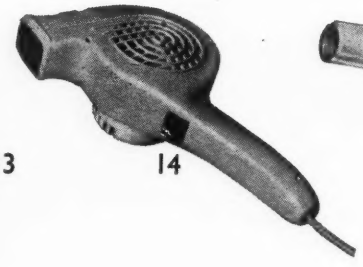

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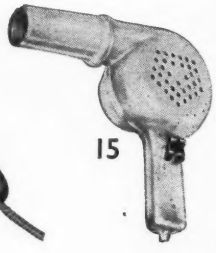

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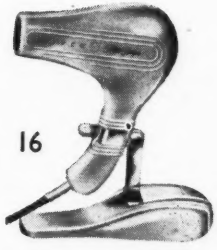

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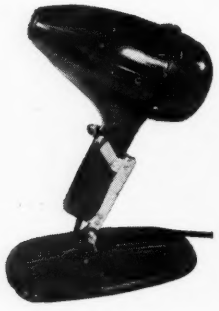

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13. *Siemens H.632. Electric Motors model.* **14.** *Morphy-Richards "H/I."* **15.** *Hillman* **16.** *Pifco model on stand.* **17.** *Ormond E.1022.* **18.** *Siroma HD.20-R*

Pifco (left) and L. G. Hawkins hair dryer hood attachments shown in use

GENERATION AND DEVELOPMENT

Larger Sets for Belvedere

The Central Electricity Authority has received the approval of the Minister of Fuel and Power to the substitution in the Belvedere power station, near Erith, of two 120,000 kW turbo-generator sets for four of the eight 60,000 kW sets authorised in the Minister's consent to the establishment of this station, which was received by the Authority in June, 1954. Belvedere, which is due to begin production in 1958, is one of the Authority's power stations to be equipped for dual firing by oil or coal.

Electricity in Miners' Houses

Houghton-le-Spring U.D.C. has accepted terms put forward on behalf of the North Eastern Electricity Board for the installation of additional electric points, including one for an immersion heater, in Council houses. The Council, before reaching a decision, expressed the opinion that as many of the tenants were miners with supplies of free coal, there would not be a great demand for immersion heaters, but the Board's representatives stated that experience in other mining areas had proved otherwise. The Council, in accepting the Board's proposals, decided that the surveyor should submit a report in two years' time on the number of tenants who had had immersion heaters installed.

Kariba Tenders

The Prime Minister of Rhodesia and Nyasaland, Lord Malvern, referring to the contracts for the Kariba Gorge hydro-electric scheme, said last week that there were no wholly British tenders; all the consortiums which submitted offers had substantial foreign components. In the case of the one with the highest British component, the tender price exceeded the Italians' figure by about £7 million.

All the contracts for power house machinery and electrical gear had been placed in Britain. Therefore a very high proportion of the manufactured goods required would be made in the United Kingdom, to swell British exports. On the other hand, by far the greater part of the balance of the expenditure would be made locally on the payment of labour and the purchase of local materials, including over 400,000 tons of cement. On the contracts let, it was estimated that only about 23 per cent of the value would be paid outside the Commonwealth. The foreign component of the loans for the first stage of the Kariba project was approximately 22·5 per cent.

The Federation imported from the United Kingdom over 45 per cent of its merchandise, and imports from the Commonwealth as a whole represented approximately 85 per cent of total imports. They were, of course, sorry that Britain did not win all the contracts for Kariba, but it was mischievous to give an impression that the Federation was favouring foreign trade at the expense of Britain.

Boom in Canadian Power Sales

Discussing significant developments of 1955 at the annual meeting of the Shawinigan Water & Power Co. (Canada) Mr. J. A. Fuller referred to the "amazing upsurge in the demand for power." The peak demand on the Shawinigan system was about 14 per cent above 1954 and sales of primary power rose by 15·4 per cent. Owing to the very dry summer and autumn conservation of water storage reserves was necessary and only a very small amount of secondary power was sold in the second half of the year.

"Many of us to-day," Mr. Fuller said, "are asking ourselves if we are not at the very peak of a boom, and therefore question the possibility of a continuation of the present upward course. It is a hard question to answer over any long period ahead, but for 1956 there is certainly not much indication of any reversal in a downward direction." For this year their estimates showed a further growth in the peak demand on their power system of 130 MW or 8·7 per cent.

Street Lighting Schemes

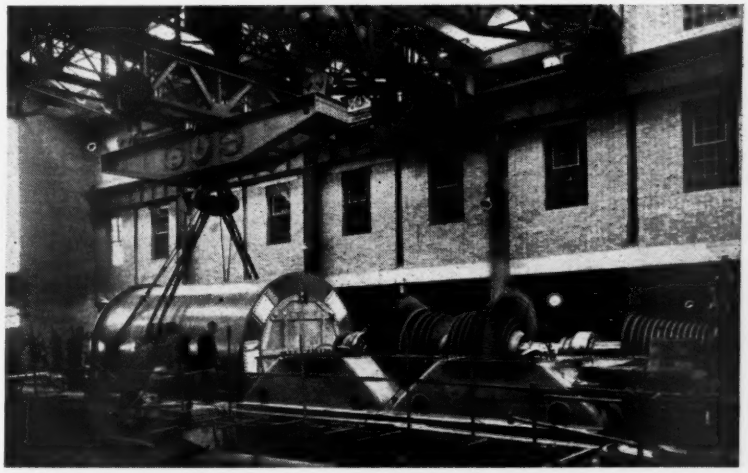
Mr. Duncan Sandys, the Minister of Housing and Local Government, last quarter sanctioned local authority loans totalling £706,921 for public lighting.

HEBBURN (Co. Durham) Works Committee has deferred until the next estimates are being considered a £3,626 scheme for installing sodium lamps, instead of mercury lamps, for street lighting.

For the latest street lighting conversion in Birmingham 139 Revo lanterns are employed, 50 on existing columns and the remainder suspended from span wires

Connaught Bridge Station

Referring to the note in our issue of 1st June, the Central Electricity Board, Federation of Malaya, states that the ceremony marked the completion, not opening, of the 80 MW Connaught Bridge power station. We are also asked to make it clear that in his address the chairman of the Board, Mr. C. G. Harrison, did not say that the country would have to rely on nuclear fuel for further sources of power but indicated that after the completion of the new Malacca steam station and the exploitation of the proposed Cameron Highlands hydro-electric scheme, the C.E.B. would be compelled to investigate and no doubt utilise nuclear fuel for the power stations which would then be required.



The stator of a Metropolitan-Vickers 60,000 kW hydrogen-cooled generator on its arrival at the North Wilford (Nottingham) power station of the Central Electricity Authority

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets expect to go quietly during the main holiday season, and on this occasion business has been restricted additionally by a feeling of suspense over the labour situation in the motor industry, and over the latest political developments in the Middle East. With little expectation of an early revival of activity, the opportunity may be taken to review the experience of markets in a year which has to date been of little profit so far to the holder of most home industrial securities. From his point of view it began badly with the increases in Bank Rate, and as the workings of the credit squeeze have made themselves increasingly manifest, they have since given markets few chances of revival.

Electrical Equipment Shares

With the aid of growing interest in the future of nuclear power, this year's performance of some of the leading electrical shares has been better than that of industrials in many other fields. As the following table shows, however, few have escaped depreciation over the seven months. Notable exceptions are the shares of C. A. Parsons, A. Reyrolle and British Aluminium, and it can be recorded that prices are mostly well clear of the low points recorded in the first quarter of the year:—

PRICES 1956

	Jan.	July	Change
A.E.I.	83/9	68/9(*a*)	−15/-(*a*)
Auto. Telephone	70/9	56/3	−14/6
Babcock & Wilcox	83/9	75/6	− 8/3
Brit. Aluminium	52/6	76/3(*a*)	+23/9(*a*)
B.I.C.C.	53/-	50/-	− 3/-
Chloride Elec. ...	73/-	62/6	−10/6
Cole, E. K. ...	22/-	17/6	− 4/6
Crompton, P. ...	15/-	13/3	− 1/9
E.M.I.	36/3	27/6	− 8/9
English Elec. ...	65/-	53/9	−11/3
G.E.C.	62/6	55/-	− 7/6
Henley's	17/3	16/3	− 1/-
J. & P.	46/3	41/3	− 5/-
Lancs. Dynamo ...	47/6	42/6	− 5/-
Lucas	38/-	31/3	− 6/9
Parsons	82/6	88/9	+ 6/3
Plessey	85/-	68/9(*a*)	−16/3(*a*)
Pye "A" ...	20/9	17/6	− 3/3
Reyrolle	105/-	108/9	+ 3/9
Westinghouse ...	97/6	72/6(*a*)	−25/-(*a*)

Note: (*a*) Prices affected by "rights" issues.

G.E.C.

General Electric is maintaining its dividend, for the year ended in March, at the total of 14 per cent to which it was raised twelve months ago. Sales of the group reached record levels, but rising costs affected profits: these were reduced by about a million to £6·6 million (before tax of £3·3 million) The distribution remains covered well over twice by the net surplus. After being marked down to about 55s following the preliminary announcement, the £1 shares were on a yield basis of a fraction over 5 per cent. Publication of the full report confirmed the assumption that the sides of the business concerned with consumer goods encountered difficult trading conditions as a consequence of the Government's restrictive measures. The order book for capital equipment is said to remain satisfactory.

Pye Dividend

A modest increase in the group trading profit for the year ended in March is reported by Pye. After a

Price Changes in

Company or Board	Nom. Value	Middle price 30th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	74½	−1	3	3	4 0 6	80½	74½
Brit. Elec. 1974/77	100	73½		3	3	4 1 9	79⅛	73⅜
Brit. Elec. 1976/79	100	77⅜		3½	3½	4 10 3	84	77½
Brit. Elec. 1974/79	100	88½		4½	4½	4 16 0	95	88
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6†	6†	6 3 0	20/9	19/-
East African Power	£1	19/6	+6d	7	7	7 3 6	21/3	19/6
Nigerian Elec.	£1	18/-		10	10	11 2 0	21/-	17/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	Nil	21/-	21/-
Perak Hydro-Elec.	£1	16/-		10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	11/6		17½	17½	7 12 3	13/6	10/6
Aerialite	1/-	4/9		88½	45*	9 9 6	6/9	4/9
Allen, W. H.	£1	36/3		20	10*	5 10 3	39/-	33/6
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	19/-	+1/-	10	5	2 12 9	—	17/-
Assoc. Elec. Ord	£1	68/9		14	15	4 7 3	85/6	57/9
Automatic Tel. & El. ...	£1	56/3		15	15	5 6 9	72/6	56/3
Babcock & Wilcox	£1	75/6		15	15	3 19 6	85/6	64/-
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/-	3/9
Bakelite	10/-	28/-		16	16	5 14 3	34/-	26/9
Berry's Electric	5/-	6/3	−3d	—	10‡	8 0 0	6/6	5/9
British Aluminium	£1	76/3	+1/3	12	12	3 3 0	77/6	40/6
B.I. Callender's	£1	50/-	−1/6	10	12½	5 0 0	54/3	45/-
B.I. Callender's 6% Pref. ...	£1	21/-		6	6	5 14 3	22/6	20/3
British Thermostat	5/-	25/-		20	25	5 0 0	31/9	24/6
British Vac. Cleaner	5/-	6/3		30	15*	12 0 0	8/9	6/-
Brook Motors	10/-	35/-	−1/3	20	25	7 2 9	44/-	35/-
Brush Ord.	5/-	5/9		10	10	8 14 0	7/9	5/9
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/6		—	22½	13 4 9	13/3	8/6
Chloride El. Storage "A" ...	£1	62/6		17½	17½	5 12 0	73/6	60/9
Clarke Chapman	£1	105/-		20	22½	4 5 9	112/6	89/6
Cole, E. K.	5/-	17/6	+3d	17½	17½	5 0 0	22/3	15/6
Cossor, A. C.	5/-	7/-		10	15	10 14 3	10/3	6/9
Crabtree	10/-	27/-		20	20	7 8 3	29/3	27/-
Crompton Parkinson Ord. ...	5/-	13/3		20	16*	6 0 9	15/-	12/3
De La Rue	5/-	17/6	+3d	30	30	8 11 6	20/3	15/-
Decca	4/-	27/6		56½	43¾*	6 7 3	44/9	24/9
Desoutter	5/-	30/6		25	30	4 18 3	32/9	25/9
Dewhurst	2/-	6/6		24	30	—	7/6	5/3
Dictograph Tel.	2/-	5/9		20	20	6 19 3	6/9	5/9
Dubilier Condenser	1/-	5/-	+9d	25	30	6 0 0	4/9	3/6
E.M.I.	10/-	27/6	−9d	10	15	5 9 0	37/-	26/3
Electrical Components	5/-	13/9	+1/3	25	25	9 1 9	16/-	12/6
Elec. Construction	£1	26/3		8½	8½	6 9 6	29/9	25/-
Enfield Cable Ord.	£1	14/9		Nil	Nil	Nil	19/3	13/6
English Electric	£1	53/9		12½	12½	4 13 0	66/3	47/3
English Electric 3½% Pref. ...	£1	13/-		3½	3½	5 15 6	14/6	12/6
Ericsson Tel.	5/-	35/6		20†	20†	2 16 3†	42/9	33/6
Ever Ready	5/-	27/6	+3d	35	35	6 7 3	32/9	24/-
Falk Stadelmann	£1	36/3		15	17½	9 13 0	45/9	36/9
G.E.C. Ord.	£1	55/-	−3/9	12½	14	5 1 9	65/6	50/-
G.E.C. 6½% Pref.	£1	22/3	−3d	6½	6½	5 16 9	23/9	21/3
General Cables	5/-	11/3		30	30	13 6 9	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Cable	5/-	22/9	−1/-	25	30	6 11 9	24/6	18/9
Hackbridge & Hewittic	5/-	18/3		30	23*	6 6 0	22/-	17/3
Heatrae	2/-	3/9		15	15	8 0 0	5/1	3/9
Henley's	10/-	16/3		10½	11½	7 1 6	19/9	14/-
Holophane...	5/-	20/3		25	30	7 8 3	20/3	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

bigger tax charge, the net surplus is again above the million mark and covers as much as five times over the dividend on the deferred capital. The 12½ per cent payment is at the same rate as before, but goes this time to capital increased by a "rights" issue in December. Following the announcement the 5s "A" deferred shares were quoted at 17s 6d. They offer a yield of 3·6 per cent. In connection with the difficult trading conditions in the radio industry, it is remembered that last year's report said that if the group made no more profits whatever from television and radio sets, the profits of the other parts of the business would be sufficient to maintain the dividend.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued						£ s d		
Hoover	5/-	25/-		70	50	10 0 0	39/3	23/-
I.C.I.	£1	46/-	−3d	10	10	4 7 0	49/9	41/3
Intl. Combustion	5/-	18/6		25	20*	5 8 0	25/-	15/3
Johnson & Phillips	£1	41/3		15	15	7 5 6	46/6	37/6
Lancashire Dynamo	£1	42/6		15	11*	5 3 6	49/9	40/9
Laurence, Scott	5/-	15/3		12½	15	4 18 3	16/9	13/3
Lister, R. A.	£1	29/3	−9d	9·3	10	6 16 9	35/3	27/6
London Elec. Wire	£1	49/6	−6d	12½	12½	5 1 0	52/9	46/5
Lucas, J.	£1	31/3	+1/-	7½	7½	4 16 0	40/3	29/6
Marryat & Scott	2/-	11/-		30	30	5 9 0	11/3	9/6
Mather & Platt	£1	52/6		15	15	5 14 3	65/3	51/6
Metal Industries	£1	19/-		9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	20/-		35	50	10 0 0	27/3	20/-
Murex	£1	71/3	+1/3	20	20	5 12 3	70/3	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/3		20	17½*	7 15 6	3/-	2/3
Parnall (Yate)	5/-	5/9		14	12	10 8 9	9/6	5/6
Parsons, C. A.	£1	88/9	+3/9	10	10	2 5 0	89/-	61/6
Plessey	10/-	68/9	−1/3	27½	30‡	4 7 3	87/6	56/-
Pye "A" Deferred	5/-	17/6	−9d	12½	12½	3 11 6	21/3	14/-
Revo	10/-	14/3		9	9	6 6 3	14/6	8/3
Reyrolle	£1	108/9	+3/9	15	16½	2 19 9	111/-	81/-
Rheostatic	4/-	9/6		18½	12‡	5 1 0	—	8/3
Richardsons Westgarth	5/-	15/6		16¾	16¾	5 7 6	17/-	13/9
Scottish Cables	4/-	16/3		27½	27½	6 15 3	17/9	15/9
Smith (England), S.	4/-	10/6		17½	17½	6 13 3	14/3	10/6
Southern Areas	£1	16/3		10	7½	9 4 6	28/9	16/3
Strand Elec.	5/-	6/9		17½	15*	11 2 3	8/6	6/9
Sturtevant	5/-	22/9		14·4†	15†	3 6 0†	31/3	22/6
Sun Elec.	£1	35/-		15	20	11 8 9	37/6	35/-
Switchgear & Cowans	5/-	13/9		20	25	9 1 9	17/-	13/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	14/-	11/3
T.C.C.	10/-	43/-		25	25	5 16 3	45/-	40/6
T.C. & M.	£1	27/6	−6d	8½	8½	6 3 9	34/-	26/-
Telephone Mfg.	5/-	7/-		10	10*	7 2 9	8/6	6/3
Thorn Elec.	5/-	17/6		20	15*	4 5 9	22/6	16/-
Thornycroft	£1	41/3	−1/3	15	15*	7 5 6	49/9	41/3
Tube Investments	£1	60/-	+1/3	22½	14*‡	4 13 3	70/6	54/9
Vactric	5/-	13/6	−3d	15	17½*	6 9 9	15/-	11/6
Veritys	5/-	8/-		12½	12½	7 16 3	10/-	6/9
Walsall Conduits	4/-	13/3		70	20*	6 0 9	13/6	10/9
Ward & Goldstone	5/-	39/6	+9d	30	35	4 8 6	38/9	29/-
Watford	2/-	6/3		25	25	8 0 0	7/6	6/3
Westinghouse	£1	72/6		18	18	4 19 3	100/-	71/6
West, Allen	5/-	12/9	+6d	15	15	5 17 9	14/6	11/6
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Am. Tel., A. Ord.	100	72½	−1½	6	6	8 5 6	80	66
Ord.	100	45½	−2	3¾	3¾	8 4 9	54	45
Anglo-Portuguese	£1	23/-		8	8	5 19 3	23/6	20/3
Brit. Elec. Traction: Def. Ord. "A"	5/-	17/-	+6d	22½	22½	6 12 3	20/-	15/6
Cable & Wireless: Ord.	5/-	10/3		10	10	4 17 6	11/3	9/6
4% Loan	100	91	+½	4	4	4 8 0	92½	88
Calcutta Trams	£1	24/-		6†	7½†	6 5 0†	26/3	23/-
Cape Elec. Trams	£1	18/3		5½	7½	8 4 6	20/3	18/-
Marconi Marine	£1	31/6		10	10	6 7 0	34/-	31/-
Oriental Tel. Ord.	1/-	73/9		16	—	—	90/-	67/6
Telephone Rentals	5/-	11/-		12½	12½	5 13 9	11/9	9/9

British Tabulating

New £1 shares offered by way of rights, at 27s, to existing stockholders of British Tabulating Machine got away to a flying start. After opening at 16s 6d the premium on the shares was quickly up to 20s. In a statement accompanying the offer, the chairman recalls his earlier references to the capital needs of this expanding business, and to the recent arrangements for co-operation with G.E.C. and an American firm in the fields of computers and automation. He expects that profits over the next year or two should permit the maintenance of the present rate of dividend on the increased capital, and that the business will continue to prosper and grow. For last year the company paid dividends totalling 9 per cent. Payment for the new shares is due to the extent of 7s by 17th August, and the balance of 20s in October.

Good Results

The preliminary statement of results from Dubilier Condenser for the year ended in March shows that profits made up, with plenty to spare, the recession of the previous twelvemonth. With an improvement this time of close on 70 per cent in the net surplus, despite a heavier tax charge, the company is able to raise the ordinary dividend from 25 to 30 per cent while still leaving more than three-quarters of the profit to be ploughed back into the business. The 1s shares have risen well lately, and at 5s show a yield of 6 per cent. Electrical Components 5s shares were also strongly supported on the announcement of results covering the same period. Earnings have again expanded well, and the distribution is maintained at 25 per cent on capital increased by a "rights" issue. At 13s 9d the shares give a return of over 9 per cent.

Motor and Electronics

The 1s ordinary shares of Motor and Electronics Corporation, which has recently held its annual meeting, are quoted at around 3s 3d, to yield approximately 6¼ per cent on the 20 per cent dividend paid for 1955. Results for that year were in all respects a record for the company. Net profits rose by about a fifth, and covered the ordinary distribution nearly three times over. Viewing prospects, the chairman reported some contraction of demand as a result of the credit squeeze on the radio industry, and with new orders showing signs of slowing down he said that the company was proceeding warily for the time being with some of its expansion plans. There had nevertheless been an improvement of some 10 per cent in the overall figures for the first part of this year, as compared with the corresponding previous period.

REPORTS and DIVIDENDS

The General Electric Co., Ltd.—Although sales were a record, profits have not kept in line because the rising costs, both in production and distribution, could not be fully recovered. The results for the year ended 31st March last have also been affected by the difficult trading conditions in certain consumer goods following the measures which the Government has taken to curb expenditure. This is stated in the company's annual report just issued.

The consolidated profit on trading was £9,752,774, as compared with £9,889,324 for the preceding year, and after deducting all charges, including £3,669,441 for taxation, and a profit of £133,373 attributable to minority shareholders in subsidiary companies, the consolidated net profit for the year attributable to the holding company is £2,759,417 (against £3,452,546). To this is added £4,883,605 brought in and £381,696, other net income relating to previous years, making £8,024,718 available. From this the following allocations have been made:—Transfer to capital reserve by subsidiary companies, £335,065; general reserve, £502,495; reserve against future stock depreciation, £510,000; reserve for increased cost of plant replacement, £500,000. It is proposed to pay a final dividend of 9½ per cent on the ordinary stock, making 14 per cent for the year on £13,714,680. The dividend for 1954-55 was also 14 per cent, but the interim dividend that year was paid on ordinary stock of £11,755,440. The balance carried forward is £4,879,351.

The report states that exports during the year reached a record figure, although overseas companies had another difficult year owing to keen competition, import restrictions and local manufacture. In addition exchange losses have had to be faced in Argentina and Pakistan, with a consequent decrease in the overall profit. The order book for capital goods remains satisfactory but the falling-off in certain consumer goods continues.

The Pirelli-General Cable Works, Ltd., of which the General Electric Co., Ltd., holds 50 per cent of the capital, reports a net profit for the year ended 31st March last of £672,899, after deducting taxation of £467,658, as compared with a profit of £642,495 for the preceding year. General reserve receives £200,000 and stock depreciation £200,000. The dividend for the year is unchanged at 10 per cent and £1,591,606 is carried forward (against £1,407,220 brought in).

Thomas De La Rue & Co., Ltd.—The annual meeting was held on 25th July, Mr. B. C. Westall (chairman) presiding. In the course of his address the chairman said that in the plastics division there had been a substantial increase in sales of both "Formica" and "Delaron" laminated plastics. Since the close of the year arrangements had been made to erect a factory for the manufacture of their plastic products in Australia. Steady progress had been made in the expansion of the "Delaron" material, particularly in its application to telephones, radio, television, and the electronic fields. In the Potterton division there was a further severe setback in the domestic cooker market due to the "credit squeeze." During the year a considerable sum had been spent on research and development covering all divisions.

The Hackbridge & Hewittic Electric Co., Ltd.—The annual meeting was held on 27th July, Mr. A. M. Browne (chairman and managing director) presiding. In his circulated statement, Mr. Browne said that the company, which was founded in August, 1906, was now in its fiftieth year. During this time the development of the specialist manufacture of transformers, rectifiers and switchgear originally started by each division had been the main concern of the company. In the past year a good export output had been maintained and at home the expansion programmes of the Central Electricity Authority and Area Boards and of the British Railways and London Transport should continue to provide an increasing scope for their products; these undertakings had taken the greater part of their home output in the past.

During the year further extensions to the factory had been put in hand and a great deal of reconstruction had been done. New testing equipment and process plant had been installed. The order book ensured that they would be fully occupied in all divisions during the coming year.

Pye, Ltd.—The trading profit for the year to 31st March last is £2,331,848, as compared with £2,199,302 for the previous year. Taxation requires £1,248,527 and the net balance is £1,071,489 (against £1,023,560). The dividend for the year on the deferred capital is maintained at 12½ per cent, but is paid on increased capital. The 8 per cent cumulative participating preferred capital receives a total of 10 per cent for the year with a final dividend of 3 per cent and a participating dividend of 2 per cent.

Hoover, Ltd., has declared an unchanged interim dividend of 10 per cent. In a half-yearly statement announcing the dividend, the directors state that sales in the home market have been seriously reduced by Government restrictions and for the first six months of this year the turnover at home is down by 29 per cent as compared with the same period last year. Overseas efforts have been intensified and the total exports are up by 13 per cent as compared with last year. Because of increased costs and lower volume on the home market, the profit margins have been reduced and this has affected seriously the overall profit figure. In spite of the lower profit earned, however, the board do not consider it necessary to reduce the interim dividend. The prospects for the second half of the year do not indicate any appreciable improvement, but much will depend on the Government's policy.

Efco, Ltd. (formerly the Electric Furnace Co., Ltd.).—The group net profit for the past year was £90,000, as compared with £130,372 for the preceding year. Taxation absorbed £84,000. It is proposed to pay a final dividend of 10¼ per cent, making 12½ per cent for the year. The distribution for the previous year was 14¾ per cent, but the interim dividend of 4½ per cent was paid before a 100 per cent scrip issue.

The Dubilier Condenser Co. (1925), Ltd.—The trading profit for the year ended 31st March last is £428,743, as compared with £265,357 for the preceding year, and after charging taxation of £165,208 the net profit is £190,715 (against £112,967). General reserve receives £155,000 and the ordinary dividend for the year is 30 per cent (against 25 per cent). The balance carried forward is £116,976 (against £124,187 brought in).

Brook Motors, Ltd.—Underwriting is being arranged by the London & Yorkshire Trust of an issue by Brook Motors of 300,000 ordinary 10s shares at £1 10s each. Ordinary shareholders will be provisionally allotted 285,215 of the shares in the ratio of one for every four shares held. They may also apply for the remaining shares and those not taken up.

Electrical Components, Ltd., reports that the group net profit for the year to 31st March last is £118,047, as compared with £98,869 for 1954-55. Taxation absorbed £134,070. It is proposed to pay a final dividend of 15 per cent, maintaining the distribution for the year at 25 per cent.

The British Oxygen Co., Ltd., has announced an interim ordinary dividend of 4 per cent on capital of £17,047,166 (against 6 per cent on £8,117,698).

Lancashire Dynamo & Crypto, Ltd., has declared an interim dividend of 4 per cent (unchanged).

New Companies

Plastic Insulated Cables, Ltd.—Registered 24th July. Capital £100. Manufacturers of and dealers in plastic insulated cables and electrical and other cables, etc. Directors: W. D'Arcy (chairman) and Mrs. Sheila J. D'Arcy. Regd. office: Cliffords Inn, Fleet Street, E.C.4.

Pollitt Engineering (Electrical) Co., Ltd.—Registered 20th July. Capital £1,000. Manufacturers of electrical and mechanical parts and assemblies which may or may not be associated with the electrical lighting, power,

heating, telephone or electronic spheres of industry; manufacturers of and dealers in dynamos, motors, armatures, magnetos, etc. Directors: W. Jenkins and Mrs. Muriel Jenkins. Regd. office: 117/117a, Anerley Road, S.E.20.

Light Service & Power Electrical Co., Ltd.—Registered 25th May. Capital £3,000. To acquire the business of L.S.P. Electrical Co., carried on at Bullace Lane, Dartford, Kent, to carry on the business of electricians, mechanical engineers, manufacturers, workers and dealers in electrical apparatus and goods in the field of electronics, etc. Directors: W. Simcock and R. Price. Regd. office: Bullace Works, Bullace Lane, Dartford, Kent.

County Electrical (Leeds), Ltd.—Registered 29th May. Capital £100. Manufacturers and repairers of and dealers in artificial lighting apparatus, electrical plant, machinery and fittings and accessories, radio and television sets, etc. Directors: G. B. Clayton, Mary Clayton and L. Drysdale. Regd. office: 51, Queens Road, Leeds, 6.

Roband Electronics, Ltd.—Registered 29th May. Capital £100. Directors: B. S. Gold and Margaret R. Gold. Regd. office: 171, Shaftesbury Avenue, W.C.2.

B. H. L. Traeco, Ltd.—Registered 29th May. Capital £2,000. Manufacturers, importers and exporters of and dealers in television, radio and electrical goods and components, etc. Directors: R. H. Lillicrapp and W. S. Barber. Regd. office: 100, Park Street, W.1.

Jaydel (London), Ltd.—Registered 28th May. Capital £1,000. Manufacturers of and dealers in electrical, gas and oil lamps, quartz lamps, reflectors, fires, bells, stoves, cookers, vacuum cleaners, switchboards, control gear, fans, furnaces, irons, dynamos, motors, armatures, etc. Directors: J. D. Leach and Margaret E. Leach. Regd. office: Lloyds Bank House, 133, Stoke Newington High Street, N.16.

Lawrence D. Wright, Ltd.—Registered 30th May. Capital £1,000. Manufacturers of and dealers in electronic, electrical, mechanical, radio and scientific apparatus and equipment, etc. Directors: L. D. Wright and Mrs. Margaret Wright. Regd. office: 63, London Road, Enfield, Mdx.

Balmore Electrics (Sales), Ltd.—Registered 5th April. Capital £100. Regd. office: Remo House, 310, Regent Street, W.1.

W. C. and F. Dobson, Ltd.—Registered 11th May. Capital £500. Manufacturers of and dealers in dynamos, motors, armatures, electrical engineers, etc. Directors: W. C. Dobson and F. Dobson. Regd. office: 42, Station Road, Gerrards Cross, Bucks.

Brennan's (Miles Platting), Ltd.—Registered 28th March. Capital £2,000. Manufacturers of and dealers in radio, television and electrical apparatus, etc. Directors: J. J. Brennan, Mrs. Margaret Brennan and B. Collins. Regd. office: 642, Oldham Road, Miles Platting, Manchester, 10.

J. J. Brennan, Ltd.—Registered 28th March. Capital £100. Regd. office: 647/653, Oldham Road, Miles Platting, Manchester. Other particulars are similar to Brennan's (Miles Platting), Ltd.

B. & F. Magneto Co., Ltd.—Registered 16th April. Capital £6,000. To acquire the business of wholesale electrical suppliers carried on by Wm. Prytherch at Caernarvon, etc. Directors: Wm. Prytherch, Ellen J. Prytherch, T. Prytherch and J. L. Prytherch. Regd. office: Greengate Street, Caernarvon.

Hamilton Electrical (Harrow), Ltd.—Registered 9th May. Capital £200. Electricians, radio and television engineers and retailers, etc. Regd. office: 13, Railway Approach, Wealdstone, Mdx.

Ashley Wholesalers (Bristol), Ltd.—Registered 3rd May. Capital £100. Electricians, mechanical engineers and manufacturers, workers and dealers in electrical apparatus and goods, etc. Directors: P. Kibby, A. J. Kibby and Ethel M. Kibby. Regd. office: 1, Ashley Hill, Bristol, 6.

J. M. Hanbury and Co., Ltd.—Registered 3rd May. Capital £1,000. Electrical equipment specialists, etc. Directors: J. M. Hanbury and Mrs. Molly A. E. Hanbury. Regd. office. Hanbury's Garage, Market Street, Torquay.

T V A Wholesale Co., Ltd.—Registered 3rd May. Capital £20,000. Manufacturers of and wholesale and retail dealers in radio and television sets, accessories and apparatus, artificial lighting apparatus, electronic and electrical fittings, etc. Directors: J. Minshull and S. Eccles. Regd. office: 25-7, Waterloo Road, Stockport, Ches.

Edenfield Electrical Engineering Co., Ltd.—Registered 10th May. Capital £250. To acquire the business of electrical contractors carried on at Edenfield, as "Edenfield Engineers (Electrical)," etc. Directors: H. P. Webb and F. Fell. Regd. office: The Workshop, Barnett Place, Market Street, Edenfield, Lancs.

J. A. Brown and Partners (Contracts), Ltd.—Registered 9th May. Capital £5,000. Electrical engineers and contractors, etc. Directors: J. A. Brown and C. Brown. Regd. office: 124, Livery Street, Birmingham, 3.

William H. Reynolds (Electrical Contractors), Ltd.—Registered 30th May. Capital £2,000. Directors: H. Reynolds and Mrs. Esther E. Reynolds. Regd. office: Bank Chambers, 180, Bethnal Green Road, E.2.

Hanwell Electrical Supplies, Ltd.—Registered 26th May. Capital £100. Dealers in and repairers of electrical and mechanical apparatus, etc. Directors: A. R. Baxter, Mrs. Jean M. Baxter and E. F. E. Carter. Regd. office: 107 and 109, Greenford Avenue, Hanwell, W.7.

Hudson & Kirkman, Ltd.—Registered 17th July. Capital £1,100. Electric lamp component manufacturers, etc. Directors: E. Hudson and W. F. Kirkman. Regd. office: 12a, South Parade, Doncaster.

Peter Ridout, Ltd.—Registered 19th July. Capital £2,000. To acquire the business of an electrical contractor carried on by Peter Ridout at Kettering, as "Peter Ridout," etc. Directors: P. Ridout and Joan M. Ridout. Regd. office: 18, Southgate Drive, Kettering, Northants.

Liquidations

T. Clarke & Co. (Liverpool), Ltd., electrical engineers and contractors.—Winding up voluntarily. Liquidator, Mr. H. Evans, 39, St. James's Street, London, S.W.1, appointed 3rd July.

T. Clarke & Co., Ltd., inform us that T. Clarke & Co. (Liverpool), Ltd., is a private company owned entirely by them and that following certain reorganisation consequent on the enlargement of the parent company's capital during the last twelve months, it has been decided to liquidate T. Clarke & Co. (Liverpool), Ltd., and take over the work previously carried out by the company.

Braun (Bletchley), Ltd., electrical dealers.—Winding up voluntarily. Liquidator, Mr. A. C. Unthank, Alderman's House, Bishopsgate, London, E.C.2, appointed 10th July.

Bankruptcies

E. Bowes, 3, Front Street, Langley Park, Durham, radio and electrical engineer.—Receiving order made 17th July on debtor's own petition. Public examination 21st September, at the Court House, Old Elvet, Durham.

A. E. Thompson, 9, High Row, Darlington, and at Clark's Yard, High Row, Darlington, electrical engineer and contractor.—Last day for receiving proofs for dividend 8th August. Trustee, Mr. N. Saddler, 4, Bridge Road, Stockton-on-Tees, Official Receiver.

F. H. Pountney, trading as Bordesley Electrical Co., 164, High Street, Bordesley, Birmingham, electrical engineer.—Supplemental dividend of 2¾d in the £, payable on and after 10th August at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

EMPLOYMENT IN 1955

THE annual report of the Ministry of Labour and National Service for 1955 (H.M. Stationery Office, 6s) states that the broad pattern of manpower distribution and the trends of labour demand and supply in 1955 were very similar to those of 1954. The total of the working population and that of manpower in civil employment again reached new high levels, while the figures of unemployment in July were the lowest since the war.

Dealing with the manpower position in various industries and services, the report expresses concern that in the basic industries there was a loss of 5,200 in the number employed in the coal mining industry; in the gas, electricity and water supply industries the high level of employment continued and by the end of the year had increased by 40 per cent over the 1947 total.

In the manufacturing industries the most marked rises in employment were in the engineering, electrical goods and vehicle group (including aircraft), where the increase in manpower amounted to 128,000, bringing the total to 3,167,000. Skilled workers in the various engineering occupations, including draughtsmen, were again in great demand and the number of unfilled vacancies for such workers increased from 26,500 at 6th December, 1954, to 30,870 at 12th December, 1955; for draughtsmen alone the number of unfilled vacancies rose from 3,204 in December, 1954, to 6,282 in December last year. During the same period the number of skilled workers who were wholly unemployed fell from 3,316 to 1,974. There was again much activity in the building and civil engineering industry and an increased demand for workers of all classes. Employment in the electric wiring and contracting industry continued at a high level.

Referring to the Technical and Scientific Register, the report states that the demand for scientists and engineers was maintained throughout 1955 at an even higher level than during the previous year; vacancies remaining unfilled at 12th December numbered 5,081, an increase of 12·7 per cent compared with a year earlier. There was keen competition among employers for mechanical engineers, electrical engineers and physicists; in particular there were strong demands for development engineers for research in the light electrical and electronic fields.

Other matters dealt with in the report are recruitment to industry, training for employment, safety, health and welfare of workpeople, and industrial relations.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 8th August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1946

28685. Sperry Gyroscope Co., Inc.—High frequency electromagnetic radiating and receiving systems. 25th September, 1946. (754530.)

1950

1093. Standard Telephones & Cables, Ltd.—Selection system for electrical circuits or equipments. 16th January, 1950. (754652.)

1097. Standard Telephones & Cables, Ltd. (Hertog, M. den).—Telecommunication exchange systems. 12th January, 1951. (754653.)

1098. Standard Telephones & Cables, Ltd. (Hertog, M. den, and Zeeuw, C. de).—Equipment for interconnecting electrical circuits such as telephone exchange circuits. 12th January, 1951. (754654.)

1953

8310. Compagnie Générale de Télégraphie sans Fil.—Electric circuits incorporating electron signal storage tubes. 25th March, 1953. (754433.)

34145. English Electric Co., Ltd.—Feathering runner vane type hydraulic turbines and pumps. 3rd December, 1954. (754335.)

1954

262. Clyde Crane & Booth, Ltd.—Devices for winding up electric conductors. 5th January, 1954. (754434.)

393. General Electric Co.—Travelling wave apparatus. 6th January, 1954. (754436.)

565. Sulzer Frères Soc. Anon.—Steam power plants. 8th January, 1954. (754213.)

1261. Philips Electrical Industries, Ltd.—Circuit arrangements for the generation of frequency modulated oscillations. 15th January, 1954. (754216.)

1548. Crabtree & Co., Ltd., A. J., and Morgan, R. W.—Electric switches of intermediate type. 10th September, 1954. (754709.)

1986. General Electric Co., Ltd., and Biggs, A. J.—Colour television receivers. 20th January, 1955. (754443.)

2771. Western Electric Co., Inc.—Switching networks. 29th January, 1954. (754338.)

2896. Chloride Electrical Storage Co., Ltd.—Electric accumulator plates. 28th January, 1955. (754661.)

3222. Philips Electrical Industries, Ltd.—Transistor oscillator circuits. 3rd February, 1954. (754713.)

3616. Licentia Patent-Verwaltungs-Ges.—Gas-blast electric circuit-breakers. 8th February, 1954. (754539.)

3827. Teddington Aircraft Controls, Ltd.—Motorised switch mechanisms for flashing lights on aircraft. 9th February, 1955. (754540.)

3862. Philips Electrical Industries, Ltd.—Frequency changing mixing circuit embodying a self-oscillating triode and intermediate frequency feed-back. 9th February, 1954. (754226.)

3920. Littlefuse, Inc.—Combined automatically and manually operable electric switches. 10th February, 1954. (754455.)

3958. Landis & Gyr Akt.-Ges.—Maximum demand mechanism. 10th February, 1954. (754230.)

4196. Standard Telephones & Cables, Ltd.—Method of etching semi-conducting material, especially germanium and silicon. 12th February, 1954. (754456.)

4543. Licentia Patent-Verwaltungs-Ges.—Dry rectifiers, particularly selenium rectifiers. 16th February, 1954. (754716.)

4792. Philips Electrical Industries, Ltd.—Mobile radio telephone systems. 18th February, 1954. (754459.)

4818. Marconi's Wireless Telegraph Co., Ltd.—Radio direction finders. 22nd December, 1954. (754460.)

5010. British Thomson-Houston Co., Ltd.—Electric circuit arrangements for producing pulses. 18th February, 1955. (754664.)

6501. Philips Electrical Industries, Ltd.—Automatic telephone exchange systems. 5th March, 1954. (754238.)

6737. Barr, Mason, Ltd., Cooper-Stewart Engineering Co., Ltd., and Hogg, J. D.—Insulating supports for electrical conductors. 4th March, 1955. (754239.)

6887. South Western Electricity Board, and Horn, D. F.—Hoist for erecting poles or the like. 9th March, 1955. (754241.)

8143. Metropolitan-Vickers Electrical Co., Ltd.—Electric arc furnaces. 2nd March, 1955. (754555.)

8747. Fernseh Ges.—Television cameras. 25th March, 1954. (754381.)

8910. Weston Electric Co., Inc.—Travelling wave tubes. 26th March, 1954. (754383.)

8953. General Electric Co.—High frequency electric discharge devices. 26th March, 1954. (754249.)

9412. Forges et Ateliers de Construction Eléctriques de Jeumont.—Operating device for electric circuit-breakers. 31st March, 1954. (754669.)

10496. Standard Telephones & Cables, Ltd.—Arrangement for magnetic concentration of an electron beam in a travelling-wave tube. 9th April, 1954. (754563.)

11036. Akt.-Ges. Brown, Boveri & Cie.—Mechanical contact current convertor with contacts oscillating in synchronism with the frequency of the alternating current. 14th April, 1954. (754671.)

11553. Radio Corporation of America.—Dual focus cathode-ray tubes. 21st April, 1954. (754261.)

11694. General Electric Co.—Photo-electric control apparatus. 22nd April, 1954. (754568.)

11700. Duurkoop, H. J.—Centrifugal electric switch. 22nd April, 1954. (754672.)

12036. Aktiebolaget Bofors.—Apparatus for the examination of objects with the aid of X-rays or gamma rays. 26th April, 1954. (754572.)

13095. Garrett Corporation.—System for paralleling two a.c. sources. 5th May, 1954. (754269.)

13439. Philips Electrical Industries, Ltd.—Methods of sealing together thick-walled hollow glass parts, more especially the edges of a glass window and cone of a cathode-ray tube. 7th May, 1954. (754486.)

13526. Leedham, G. V.—Electrically heated combination tool for paint removal and branding. 22nd April, 1955. (754488.)

14073. Hotpoint Electric Appliance Co., Ltd.—Lubrication of small electric motors and generators. 13th May, 1955. (754272.)

14854. Etablissements Merlin & Gerin Soc. Anon.—Electrical arc extinction chambers. 20th May, 1954. (754276.)

15827. Philips Electrical Industries, Ltd.—Degeneratively back-coupled transistor amplifiers. 28th May, 1954. (754356.)

17232. Aircraft-Marine Products, Inc.—Electrical connector. 11th June, 1954. (754493.)

19174. Philips Electrical Industries, Ltd.—Stators for single-phase induction motors. 30th June, 1954. (754600.)

19756. Western Electric Co., Inc.—Distortion-correcting circuits. 6th July, 1954. (754365.)

20009/10. Philips Electrical Industries, Ltd.—Methods of applying light-diffusing layers to glass surfaces. 8th July, 1954. (754368/9.)

20081. Siemens-Schuckertwerke Akt.-Ges.—Electric power switch apparatus. 8th July, 1954. (754498.)

20593. Bresges, O.—Electrically driven multi-purpose devices. 14th July, 1954. (754286.)

20864. Philips Electrical Industries, Ltd.—Circuit arrangements comprising cathode-ray tubes. 16th July, 1954. (754605.)

20976. Holm, S.—Ceramic magnetic material. 19th July, 1954. (754370.)

21141. General Electric Co.—Bonding of metal borides to graphite. 20th July, 1954. (754499.)

21407. Monroe Calculating Machine Co.—Selection circuits embodying saturable magnetic cores. 22nd July, 1954. (754607.)

21909. British Thomson-Houston Co., Ltd.—Conveyor drives. 27th July, 1954. (754681.)

22298. Standard Telephones & Cables, Ltd.—Method of producing semi-conductor junction crystals. 30th July, 1954. (754289.)

22885. Marconi's Wireless Telegraph Co. Ltd.—Frequency modulated radar systems. 23rd May, 1955. (754397.)

23064. Clevite Corporation. — Electro-mechanical transducer element and process of making same. 9th August, 1954. (754501.)

23433. Fernseh Ges.—Television pick-up apparatus. 12th August, 1954. (754611.)

23623. Compagnie Telma.—Eddy current braking devices. 13th August, 1954. (754399.)

24309. British Thomson-Houston Co., Ltd.—Infra-red ray generating device. 20th August, 1954. (754616.)

24923. Westinghouse Electric International Co.—Electrical devices of the semi-conductor type. 27th August, 1954. (754404.)

27546. Siemens & Halske Akt.-Ges.—Ionisation manometers. 23rd September, 1954. (754515.)

27888. Gaylord Products, Inc.—Speed responsive electric switches. 27th September, 1954. (754691.)

28129. Apparatebau Akt.-Ges. Goldach.—Electric dry shavers. 29th September, 1954. (754516.)

28350. Mullard Radio Valve Co., Ltd.—Gating circuits for selecting electric pulses. 1st October, 1954. (754625.)

28537. Standard Telephones & Cables, Ltd.—Method for the production of ferrites and particularly for the manufacture of permanent magnets. 4th October, 1954. (754626.)

29051. Standard Telephones & Cables, Ltd.—Radiation detector. 8th October, 1954. (754411.)

29618. Research Corporation.—Electrostatic precipitators. 14th October, 1954. (754520.)

29911. Soc. d'Etudes de Realisation et d'Exploitations Commerciales.—Means for closing the elements of electric batteries. 18th October, 1954. (754309.)

30051. Philips Electrical Industries, Ltd.—Colour television receivers comprising at least two picture tubes and suitable also for the reproduction of black-and-white television signals. 19th October, 1954. (754630.)

30886. Skillman & Co., Pty., Ltd., T. S.—Steady state signalling systems using alternating currents. 26th October, 1954. (754523.)

31954. General Electric Co.—High temperature alloys. 4th November, 1954. (754417.) 31955. Surface finishing of tantalum and alloys thereof. 4th November, 1954. (754317.)

32610. Telefonaktiebolaget L. M. Ericsson.—Signal transformation devices employing secondary emission electron tubes. 10th November, 1954. (754319.)

33358. Soc. Anon. Francaise du Ferodo.—Electro-magnetic clutches and circuits therefor. 17th November, 1954. (754639.)

33877. Goodyear Tyre & Rubber Co.—Sawtooth waveform generator. 23rd November, 1954. (754321.)

[*Continued at foot of page 229*

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—17th August. Monaro County Council. 5/7·5/10 kVA transformers. (E.S.B. 18719/56. Ten/20409.)*

7th September. Brisbane City Council. Ten-pair aerial pilot cable. (E.S.B. 18140/56. Ten/20349.)*

3rd October. State Electricity Commission of Queensland. 450-500 kW convertible type engine-driven generating plant. (E.S.B. 18615/56. Ten/20446.)* 10th October. Two circulating water pumps for a 15,000 kW turbo-alternator set. (E.S.B. 19020/56. Ten/20495.)*

Belfast.—8th August. City and District Water Commissioners. Electrical installation in the offices, works and garages at Oldpark Back Row. McAuslan & Abbott, consulting engineers, 16, Bedford Street.

8th August. Antrim County Health Committee. Electrical wiring and heating installation in Dunmurry welfare centre. Thomas H. Houston & Co., architects, 26, College **Gardens.**

13th August. Board of Governors. Electrical installation in St. Monica's Girls' Intermediate School, Ravenhill Road. McLean & Forte, architects, 37, Malone Road.

20th August. Northern Ireland Hospitals Authority. Electrical installation in the Special Care Hospital, Glenravel Street. J. R. W. Murland, consulting engineer, 13, Wellington Place.

Blackrod.—18th August. U.D.C. Street lighting equipment. Surveyor, Council Offices, Blackrod, near Chorley.

Brierley Hill.—18th August. U.D.C. Electrical installation in the civic buildings. J. R. Moore, housing director, Civic Buildings.

Burma.—20th August. Union Purchase Board. Electrical food preparation equipment including cookers, dish washers, warming cabinets, water coolers, insulated milk containers, toasters, etc. (E.S.B. 18921/56. Ten/20437.)*

Egypt.—15th August. Egyptian Government. Cables and accessories. (E.S.B. 19035/56. Ten/20488.)*

1st September. Telegraphs and Telephones Administration. Private automatic branch exchange. (E.S.B. 18458/56. Ten/20403.)*

4th September. Cairo Electricity and Gas Administration. Insulated underground cables. (E.S.B. 19032/56. Ten/20474.)*

12th September. Ministry of Municipal and Rural Affairs. Electric generators for Dessouk and El Fikria power stations. (E.S.B. 18382/56. Ten/20407.)*

NEW PATENTS

(*continued from page* 228)

34372. General Electric Co.—Bed covers. 26th November, 1954. (754696.)

34582. Elektrokemisk Aktieselskap.—Electrolytic furnaces for the production of aluminimum. 29th November, 1954. (754697.)

35010. Electrode holders for electric furnaces. 3rd December, 1954. (754641.)

35049. Standard Telephones & Cables, Ltd.—D.c. voltage regulators. 3rd December, 1954. (754325.)

36096. Bosch Ges., R.—Dynamo electric machines. 14th December, 1954. (754327.)

1955

23728. Rade Koncar Tvornica Elektricnih Strojeva. — Stators for dynamo-electric machines. 11th June, 1954. (754430.)

1956

4997. Standard Telephones & Cables, Ltd.—Automatic telecommunication exchange equipment. 16th January, 1950. (754702.)

Ilkeston.—3rd September. Borough Council. Street lighting equipment. (See this issue.)

India.—8th August. Director General of Supplies and Disposals. 11,200 yd of aerial conductor. (E.S.B. 18246/56. Ten/20358.)* 31st August. Cables. (E.S.B. 18929/56. Ten/20431.)*

15th August. Government of Mysore. Two 1,500 kVA transformers. (E.S.B. 18939/56. Ten/20458.)* Two 3,000 kVA transformers. (E.S.B. 18940/56. Ten/20459.)*

28th August. India Store Department, Acton, London, W.3. 66 and 132 kV transmission line tower and accessories. (See this issue.) 31st August. Transmission line conductors, earth-wire and tower earthing sets, etc. (See this issue.) 18th September, 12 V, 40 A secondary lead acid batteries. (See this issue.)

10th September. Government of Andhra. Synchronous condensers for Gunadala substation. (E.S.B. 18618/56. Ten/20387.)*

25th September. Superintending Engineer, Koyna Project, Bombay. Pressure shafts, power house and appurtenances. (See this issue.)

Kirkburton (near Huddersfield).—18th August. Storthes Hall Group Hospital Management Committee. Lighting equipment for the drive at Storthes Hall Hospital. (See this issue.)

Llandudno.—24th September. U.D.C. Conversion of winding gear of the Great Orme Railway from steam to electric drive. (See this issue.)

New Zealand.—7th August. Municipal Electricity Department, Christchurch. Twenty 200 kVA transformers. (E.S.B. 18598/56. Ten/2038.)*

29th August. General Post Office. 380,000 fuses. (E.S.B. 18907/56. Ten/20426.)* 150 cells and 1,728 battery clips. (E.S.B. 18909/56. Ten/20471.)*

Pakistan.—23rd August. Posts and Telegraph Department. 120 teleprinters and accessories. (E.S.B. 18927/56. Ten/20434.)* Harmonic suppression filters. (E.S.B. 18050/56. Ten/20348.)*

Park Prewett.—31st August. Group Hospital Management Committee (South West Metropolitan Region). Supply of electric lamps (Contract No. 6) to Park Prewett Hospital for the six months commencing 1st October, 1956. F. Hales, Group Secretary to the Hospital Management Committee, Basingstoke, Hants.

South Africa.—24th August. Stores Department, South African Railways. Dry cells. (E.S.B. 18924/56. Ten/20457.)* Overhead track equipment. (E.S.B. 18972/56. Ten/20479.)* Junction cable and equipment. (E.S.B. 18923/56. Ten/20456.)* Electrical signalling material. (E.S.B. 18973/56. Ten/20455.)*

16th August. Union Tender and Supplies Board. P.v.c. switchboard cable. (E.S.B. 19124/56. Ten/20497.)*

Uruguay.—24th August. Usinas Electricas y los Telefonos del Estado. Accessories for h.v. lines. (E.S.B. 18602/56. Ten/20425.)*

Ware.—18th August. U.D.C. Street lighting equipment. A. G. Davenport, surveyor, The Priory, Ware, Herts.

ORDERS PLACED

Hartlepool.—Corporation. Installation of electricity in 70 houses (£1,727).—E. Dixon Barker & Son.

Newcastle-on-Tyne. — Education Committee. Electrical installations in new schools:—Firfield County Secondary Boys' School (£6,801).—Robson & Coleman. Rutherford High School (£13,658).—William Brothers (Electrical). Rutherford College of Technology (Stage 3) (£19,552).—Veale-Nixon.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barking.—Office block, Ripple Lane; W. & C. French, Ltd., builders, 50, Epping New Road, Buckhurst Hill.

Barnes.—Flats (48), Grove Road and Mortlake High Street; borough engineer.

Barwell.—Flats (16), King George's Way, and houses (26), Waterfall estate; U.D.C. architect, Hinckley, Leics.

Belford.—Block of flats; K. W. Kirk, R.D.C. surveyor.

Birkenhead.—Houses (72), Manor Drive estate; R. Costain & Sons, Ltd., builders, Barlows Lane, Liverpool.

Birmingham.—Abattoir and meat market at Castle Bromwich (£1,000,000) to replace one in the city centre; A. G. Sheppard Fidler, city architect, Civic Centre.

Bradford.—Rhodesway Secondary School at Allerton (£240,000); W. C. Brown, city architect.

Bristol.—Rebuilding war destroyed premises and additions (three-storey elevation), Temple Gate; Mardon, Son & Hall, Ltd., printers and boxmakers, Temple Street, 1.

Cambridge.—Department of Engineering for University; Coulson & Son, Ltd., builders, St. Andrew's Street.

Cardiff.—Dwellings (288) with shops, etc., as development of 47-acre estate north of Llanedeyrn Road; city surveyor, City Hall, Cathays Park.

Croydon.—Flats (53) in Denmark Road; E. Taberner, town clerk, Town Hall.

Dagenham.—College of Further Education at Bush Green; borough engineer, Civic Centre.

Durham.—Branch libraries at Murton and Blackhall; county architect, South Street.

Eston.—Central county modern school for North Riding E.C.; Davis, Belfield and Everest, architects and surveyors, 9, Ashley Place, London, S.W.1.

Exeter.—Dwellings (70), Stoke Hill estate; city architect.

Exmouth.—Classrooms, practical rooms, cloakrooms, library, hall, gymnasium, etc., at Rolle College (£80,000); Devon county architect, 97, Heavitree Road.

Felling.—Special day school, High Heworth Lane; county primary at Millford; and secondary modern at High Lane/Sunderland Road; G. H. Metcalfe, director of education, Shire Hall, Durham.

Hotel for Newcastle Breweries, Ltd.; D. Glen, Albert Road, Jarrow.

Folkestone.—Office block at Salisbury Road; C. J. Nickolls, Ltd., haulage contractors, 65, High Street, Cheriton.

Gateshead.—Houses and bungalows (98) at Easington Avenue; Wimpey & Co., Ltd., builders, Orchard House, Newcastle-on-Tyne.

Proposed Greenwell County Modern School; G. Winters, borough engineer.

Grantham.—Old people's home in Welby Gardens (£41,000); county architect, Sleaford, Lincs.

Halifax.—Health Department offices and maternity and child welfare clinic, on the St.

James's Church vicarage site; G. Holden, borough surveyor, Crossley Street.

Hamilton.—R.C. secondary school at Udston (£206,000); county architect, County Buildings, Hamilton.

Heanor.—Administration block, Fair View; I. & R. Morley, Ltd., Fletchergate, Nottingham.

Heston.—Dwellings (198), Cranford Lane estate; Tersons, Ltd., builders, 4, Dollis Park, London, N.3.

Kingston-on-Thames.—Offices and research buildings; Hawker Aircraft, Ltd., Richmond Road.

London.—Office block, Bow Road, Bow; Tersons, Ltd., builders, 4, Dollis Park, N.3.

Dwellings (36), High Road, Greenwich; borough engineer.

Surgical block for Guy's Hospital, Southwark; W. H. Watkins, Grey & Partners, architects, 57, Catherine Place, S.W.1.

Flats (66), Portland Rise, Stoke Newington; Wm. Moss & Sons, Ltd., builders, North Circular Road, N.W.2.

Occupation centre at Perry Rise, Lewisham (£46,400), for L.C.C.; Dr. J. L. Martin, Architects' Department, County Hall, Westminster Bridge, S.E.1.

Market Bosworth.—Bungalows (50); R.D.C. architect, Market Bosworth, Leics.

Middlesbrough.—Four-storey departmental store; J. Newhouse, Ltd., drapers, etc., The Corner, Middlesbrough.

Millom.—Extensions to secondary school (£211,000); J. H. Haughan, county architect, 15, Portland Square, Carlisle.

Newcastle-on-Tyne.—Depot, offices and canteen, Vicars Lane, for Beecham Foods, Ltd.; Cackett, Burns Dick and MacKellar, architects, 21, Ellison Place.

Bank premises and offices, Northumberland Street; Barclays Bank, Ltd.

Factory block, Edgefield Avenue, Rowntree & Co.; J. Laing & Son, Page Street, Mill Hill, London, N.W.7.

North Shields.—Factory in Bird Street for T. B. Bilton & Sons, engineers; J. H. Rogers, builder, Regent Terrace.

Rayleigh.—Grammar school, London Road; U.D.C. surveyor, Council Offices, Hockley Road, Rayleigh, Essex.

Richmond (Yorks).—County modern school; D. C. Hall, 6 Mason's Yard, Duke Street St. James's, London, S.W.1.

Rochester.—Flats (21), Corporation Street; borough surveyor.

Scarborough.—Flats (98) for the T.C.; Builders: E. Hunter, Ltd., Beaconsfield Street (46) and F. Shepherd and Son, Ltd., Falsgrave Road (52).

Scunthorpe.—Works, Warren Road; British Oxygen Co., Ltd., Bridgwater House, Cleveland Row, London, S.W.1.

Sedgefield.—Houses (54) at West Cornforth; R.D.C. housing architect.

South Shields.—Houses, two cinemas, community hall and two churches at Marsden; borough engineer.

Southampton.—St. George's R.C. three-form entry secondary school at Swaythling (£155,000); Richard Sheppard & Partners, architects, 5, Southampton Place, London, W.C.1.

Southend-on-Sea.—Eastwood High School for Girls (£150,233); borough architect, 30, Alexandra Street.

Spennymoor.—Development of sites for houses (339); G. H. Gray & Partners, Camden Street, North Shields.

Stanley (Co. Durham).—Houses (100), at Stanley Hill Top; U.D.C. surveyor, Council Offices.

Staveley.—Old people's home (£36,000); county architect, Matlock.

Stevenage.—Houses (70), in the old town area; N. M. Priestland, U.D.C. clerk, Council Offices, Stevenage, Herts.

Stockton-on-Tees.—Two-storey offices and showrooms, Norton Road, for T. Cowie, Ltd.; M. Trotter, architect, 134, High Street.

Houses (24) on allotment land near Stanley Street; borough architect, 28, The Square.

Sunderland.—Houses (147), Hylton Red House estate; L. W. Evans, Ltd., contractors, Norfolk Street.

Additions to Sunderland Technical College (£350,000); borough architect, Stockton Road.

"Unity" flats (200) in the Lawrence Street development area; C. M. Yuill, Ltd., builders, Villiers Street, West Hartlepool.

Office block for J. Wilsons Sawmills, Ltd.; Matkin & Hawkins, architects, Barclays Bank Chambers, Fawcett Street.

Agricultural twine making factory (£27,000); British Ropes, Ltd., Sunderland.

Thornton Heath.—Maisonnettes (32), Parchmore Road; Lawdon Partners, Ltd., builders, 157, Victoria Street, London, S.W.1.

Tonbridge.—Houses (100), Higham Wood estate; borough surveyor.

Totnes.—Conversions at Castle Hotel, to form shops, offices, etc.; Pearl Assurance Co., Ltd., High Holborn, London, W.C.1.

Tynemouth.—Old people's hostel at Cullercoats; borough engineer, 16, Northumberland Square, North Shields.

Wallsend.—Flats (84); borough surveyor.

West Ham.—Dwellings (161), Canning Town; borough engineer, Town Hall, Stratford, London, E.15.

West Hartlepool.—Houses (64), Owton Manor estate; C. M. Yuill, Ltd., builders, Villiers Street.

Winchester.—Houses (166), Winnall Manor estate (£246,670); Hawkins Bros. (Gosport), Ltd., builders, Westfield Road, Gosport.

Worcester.—New staff accommodation at Powick Mental Hospital (£44,000); Birmingham Regional Hospital Board, 10, Augustus Road, Edgbaston, 15.

Worsley.—Dwellings (223), Little Hulton; U.D.C. surveyor.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 11th August:—

MINIPONENT. No. 752,739. Class 9. Transformers, inductances, cut-outs, switches, relays, resistances, metal terminals, condensers, connectors, potentiometers, transducers, cable and insulated wire; and thermionic valves and semi-conducting devices for use in electric and electronic apparatus.—Electronic Instruments, Ltd., Lower Mortlake Road, Richmond, Surrey.

"ZEBRA." No. 753,075. Class 9. Electronic calculating apparatus and parts.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

ROOTWAY. No. B750,667. Class 11. Soil-warming apparatus for horticultural purposes.—Electronic Precision Equipment, Ltd., 123, Terminus Road, Eastbourne, Sussex.

LISSCO. No. B751,135. Class 11. Installations for lighting; electric ceiling, table and standard lamps and parts; and tubes and bulbs all for electric lighting.—Lissco Products, Ltd., Commerce Way, Lancing, Sussex.

ATLAS SOFTLIGHT. No. 752,525. Class 11. Electric lamps and electric light fittings.—Thorn Electrical Industries, Ltd., 105 and 109, Judd Street, London, W.C.1.

Opportunities in India

MR. S. GARVIN, head of the General Division of the Overseas Directorate of the Federation of British Industries, spent three months in India earlier this year and he has now prepared a report, "India: A Survey for British Industrial Firms," which has been published by the F.B.I. (price 4s 6d).

Mr. Garvin says that Indian industrialisation will create for Britain more opportunities than it destroys. He points out that India takes one-quarter of all her imports from the United Kingdom and sends to Britain one-third of her exports; yet in spite of the advantages which Britain enjoys in India they will not be retained, nor will Britain rise to the full level of her opportunities there, without constantly renewed initiative and enterprise during these formative years. As the Indian national income rises, the market for British exports will expand, but Mr. Garvin adds the warning that competition is keen, especially from Western Germany and Japan, and it is also increasing from Russia and the industrialised "iron curtain" countries.

After dealing with the political background, he discusses the second Five-Year Plan and some of the major schemes of development, including the doubling of the capacity of the existing plants of the Tata Iron & Steel Co., Ltd., and the Indian Iron & Steel Co., Ltd., and the construction of three new Government-owned steel plants. In the field of power development he refers to the Bhakra Nangal Project which includes the construction of the Bhakra Dam and of four new power stations, two at Bhakra Dam and two at Nangal. Appendices to the report show the amount which is to be spent on the major schemes of development and the output targets for some of the major industries. There are also some useful notes for the guidance of exporters.

Irish Conference and Exhibition

The Irish Electricity Supply Board proposes to organise a week's conference and exhibition in Dublin next February to bring to the attention of Irish industrialists and their technical staffs the various ways in which electricity can be used to increase production, improve quality and generally to demonstrate more efficient methods and techniques in different industries. The conference will include papers by experts on various applications of electric power and heat in industry. Manufacturers of electrical and materials handling equipment are being invited to display equipment designed for more efficient and economic industrial production. The Royal Dublin Society has made available its main hall and annexes for the conference and exhibition. Application for space should be made to the Electricity Supply Board, 27, Lower Fitzwilliam Street, Dublin.